

holding more than 50 family units), is strung out in a single 4-mile-long chain, neatly placed between a 12-lane super-highway (which cuts the development off neatly from the rest of the city) and, on the other side, a series of large manufacturing plants (with their perennially belching smokestacks) and a large municipal dump. In spite of all the old ghetto's faults, it did have a "sense of community," and that has been destroyed completely.

The inhabitants have no park, green spaces, or even lone trees within walking distance. Each family is alienated from the rest; nights find them cowering in their cell-like apartments while the juvenile street gangs exchange gun-fire down below. In just *one* of these buildings, more than one case of rape or assault occurs daily, and between 3 and 4 cases of murder or attempted murder each week! The ghetto has been verticalized neatly and turned into a series of skyscrapers. Visually all the buildings are identical and look like a series of cement slabs into which a child has carved an insufficient number of tiny windows.

This area is also completely divorced from even the most basic shopping needs. A supermarket and a drugstore are located about 500 feet from the northernmost of the buildings, and public transport is lacking. This means that an elderly woman living, for instance, in one of the buildings at the south end of the development, has a 5-mile walk (round trip) in order to do her shopping. Thus a mother of small children is effectively removed from supervising her offspring for a period of nearly 3 hours when marketing. But the design of these barns for the storage of unskilled laborers and their families is not that different from similar developments for the well-to-do, or the rich.

It is a strange paradox in the design field (at least in the United States) that as our families have become larger in size, and as the furniture and furnishing designed for us take up more space, the size of our houses or apartments, as well as of individual rooms, has shrunk unaccountably. As a family achieve

the financial means to leave these mega-blocks of flats, they are propagandized into buying a "home of their own." These homes again lack any and all individuality, and are strung out in a manner most convenient for the speculative builder, his machinery, and the plumbing and street network which he installs, rather than for the needs of the people. If the prospective buyer is less than enchanted by 600 fake New England saltboxes, identical in looks and materials and placed cheek-by-jowl, usually his only choice consists of moving to another development in which another 600 equally phony French Provincial huts rub shoulders.

Even on low price levels, in 1969, the price of one of these homes is (in the United States) approximately that of 3 years of income of their prospective tenants. Naturally, these homes are purchased under deferred payment plans, mortgage settlements, and the like, usually covering a time period of 20 or 30 years. Compound interest usually adds 70-100 per cent or more to the price, and the family almost invariably moves out after 3 or 4 years. Should a tenant be foolish enough to attempt to individualize his own home through landscaping, planting, and other improvements, his neighbors will frequently heap scorn and abuse on him. Whether or not they do, his taxes will very probably be raised.

But all this is wide off the mark. What should be of concern to the designer is the relationship between the home and the way in which people live today. "Saleability" of mass housing is usually measured by how closely the houses conform to a late-nineteenth-century ideal of the trellised, rose-covered cottage. The fact that our style of life in the early seventies of this century (including such factors as: minimally four separate systems of telecommunication, "automobility," and increased leisure time, as well as the fragmentation of the basic family structure) is never taken into consideration. Nor the fact that the average American family moves approximately every 4.6 years.

Most importantly, however, the basic human need to have some relation to green and growing things, as well as the option to do a bit of gardening or "farming" (for table crops such as tomatoes, lettuce, squash, and melons) is never taken into consideration. Nor is walking space, or play space for children, teen-agers, and adults.

Most designers (and not just in the areas of housing and community planning) seem to have developed a set of blinders. This *effectively keeps them from considering whether similar problems might not already have been solved intelligently somewhere else or at some other time.*

Say "Frank Lloyd Wright" to any shelter designer. He will immediately think of the Guggenheim Museum, Fallingwater, the Imperial Hotel in Tokyo, and some of the earlier Prairie Houses. He may even think of a certain mannerist, neo-baroque interpenetration of space. But chances are that he will be totally unaware that Wright created an important "missing link" between individual homes and apartment dwellings.

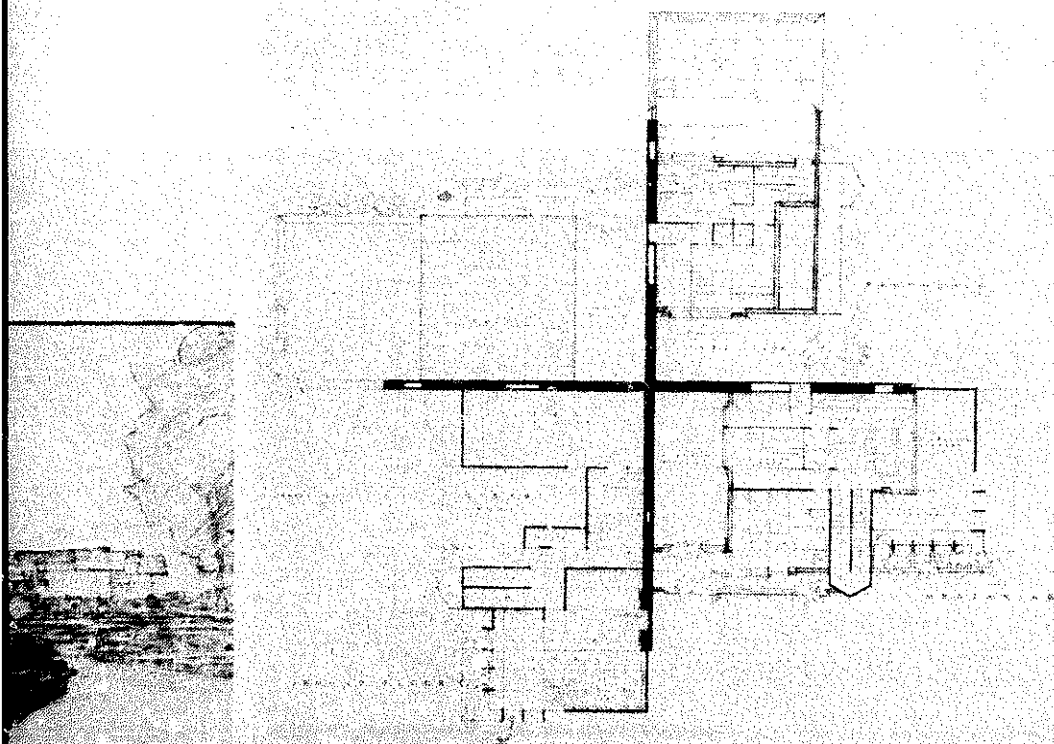
BELOW: View of Frank Lloyd Wright's Cloverleaf Housing project that was to be built at Pittsfield, Massachusetts, in 1942. By Permission of the Frank Lloyd Wright Foundation. Copyright © 1969 by The Frank Lloyd Wright Foundation.

RIGHT: Cloverleaf Housing plan. By permission of The Frank Lloyd Wright Foundation. Copyright © 1969 by The Frank Lloyd Wright Foundation.



In 1938, Frank Lloyd Wright designed the Sun Top Homes for Ardmore, Pennsylvania. Only one of the proposed four was actually built. It is really a cloverleaf-like interpretation of 4 individual homes. Each one consists of a one and one-half story tall living room, and distributes a recreation room, bedrooms, kitchen, etc., over a 2-story area. Each individual quarter of the total 4-home construct is so defined that one is unaware of the other 3 units. The heating-air-conditioning-plumbing core is in the center of the complex. Nonetheless, each individual unit has its own air-conditioning, plumbing, and lighting facilities as well as its own kitchen garden, and a recreational garden, screened through trees and plantings from the other units and from the street. The entire building was extremely low in cost and actually built (as a first prototype) in 1941. In 1942 Mr. Wright further developed this concept for the Defense Housing Agency. One hundred of these cloverleaf homes (to house 400 families) were to be built at Pittsfield, Massachusetts.

The original Sun Top Homes prototype still stands



at Ardmore, Pennsylvania, one third of a century later, mute testimony to the short-sightedness of the Federal Government.

The mix of heavy manufacturing offices, light industry, private homes, apartment-like shelters, clinics, day nurseries, schools and universities, sports arenas, recreational facilities, bicycle paths, access roads, forested areas, parking lots, shopping communities, and linkages to public transport and high-speed road networks which Frank Lloyd Wright designed in 1935 as Broadacre City, still marks a high point of humanistic planning. With local variations, Wright envisioned Broadacre City as eventually spanning the entire North American continent. Again, this is not to suggest that either Broadacre City or the Ardmore Development is the ideal answer.

According to Frank Lloyd Wright, *scale* was the greatest threat to social meaning. As early as the forties, he wrote: "*Little forms, little homes for industry, little factories, little schools, a little university going to the people mostly by way of their interest . . . little laboratories. . .*" (Wright's italics).

Like Tapiola near Helsinki, Broadacre City and the Ardmore Development constitute partial solutions, but solutions more concerned with the quality of life and human dignity than the nearly 12 million rabbit hutches that have been built for human habitation since.

The whole concept of human scale has gone awry, not only with homes but in most other areas as well. One would expect a system motivated only by self-interest and private profit-making at least to spend some care in constructing its shopping places. This is not so. "*Strøget*," a "walking street" of shops in downtown Copenhagen, is constructed for leisurely strolling and impulse buying. Two segments of it, *Frederiksborggade* and *Mygade*, are together approximately 400 feet long and contain more than 180 shops.

In a contemporary American shopping center, this same distance of 400 feet will frequently separate the

entrances of two stores: the supermarket and, say, the drugstore. The intervening space consists of empty windows, bereft of displays, monotonous and uninteresting. Usually neither landscaping nor wind-breaks are provided. Mercilessly, the hot sun beats down on the 4 acres of concrete in the summer; wind-whipped snow piles up in car-high drifts throughout the winter. Small wonder that, after finishing their shopping at the supermarket, people will walk back to their automobiles and drive to the drugstore. There is nothing in the environment that prompts going for a stroll; it has been designed for the moving car alone. Most shopping plazas in the United States consist of a thin line of stores arranged along three sides of a huge square, the center of which is a parking lot. The large open side fronts on a super-highway. This may make shopping "efficient" but it also makes it something less than satisfying.

This problem of scale is especially dramatic in our suburbs and exurbs, which have become vast dormitory towns with a multiplicity of problems.

Increasingly within the last decade, factories have moved away from large cities: cheap labor sources and large tax write-offs have induced them to move to so-called "Industrial Parks." (!) Foreseeably, more and more factories have begun congregating within each one of these so-called park sites. Around each of these clusters service industries, shops, and, eventually, tract housing has sprung up—without any plan, reason, or projection for future development. Transportation networks soon link these production centers to the old cities (crossing the suburbs and exurbs of yesteryear on their way). Soon a whole new subculture of minor assembly plants, repair shops, storage plants, etc., develops in the relatively large border area between city and suburbs, suburbs and satellite industrial centers. Without any rational plan, the city has just grown in area by a factor of 20 or 30 (due to the nature of this particular, omni-directional growth process).

Even if we are willing to accept psychological,

social, and physical hazards in polluting our environment, there are other more immediate and weighty reasons for putting a stop to it. Recent information coming to us from weather satellites in space, direct observation in spaceships, and the statistics provided to us by meteorological observation stations quite clearly points to a major change. It seems that a large area of permanently polluted warm air will actually *attract* bad weather. In the American Midwest and East Coast especially, more and more major storms, snowfalls, blizzards, and tornadoes have, over the last ten years, hit large industrial cities. This phenomenon in turn (by increasing the number of target areas on the world's surface) in time may have lasting climatic effects. This is the curse of scale, when not attended to. As Julian Huxley remarks: "Simply magnify an object, without changing its shape, and without meaning to, you have changed *all* its properties."

Even the most basic study of systems design teaches us the obvious fact that a system is made up of its component parts, and that, as each part is changed, the system itself eventually will change too. By examining some of these systems we may be able to locate some of the factors contributing to the distortion. Hospitals and mental institutions are usually designed with greater care than other interior spaces. Architects, interior architects, and medical specialists routinely cooperate in the planning. In the floor plan, the rest-and-recuperation wing of a mental hospital at first may be well arranged for conversational grouping, relaxation, games, etc. But once the wing is put into operation, hospital personnel rearrange the seating at once. Chairs now are placed primly, neatly, and symmetrically. This has the virtue of bolstering the sense of security of the hospital personnel, cuts down the time needed to sweep and wash floors, and makes it far simpler for refreshment carts to be wheeled through the room. This furniture placement, however, creates fantastic barriers to interaction among patients, and in some cases may help to drive them into autistic or

catatonic states. The placement of chairs on the four sides of each pillar, facing in four different directions, makes conversation extremely awkward for two people seated adjacently and completely shuts off conversation with anyone else.

This is no isolated example but rather something that happens in hospital wards all the time. It illustrates a cardinal error among designers: the failure to go back from time to time and see how the work has performed and been implemented. To my knowledge, hospital or mental patients have never been "client-group representatives" working with a design team. Similar observations can be documented regarding prison populations, the arrangement of living spaces for military personnel, university students in dormitories, and other victimized groups held in captivity. Even in areas where a profit-seeking system might be expected to pursue its ends most efficiently, this is not often the case.

Edward T. Hall, in his studies of proximeters and human spacing, has computed that the types and sizes of seating units used in most contemporary airport terminals so strongly violate Western concepts of spacing that fully one third of them are empty at any given time. This holds true even when the building is unusually crowded: many people prefer standing or pacing to being brought into too close proximity with strangers. Most Americans visiting Europe or Latin America demonstrate signs of minor strain when asked to share a restaurant table with strangers. And seldom has Thorstein Veblen's theory of "conspicuous consumption" been carried further than in the endless vestibules of motion picture palaces, tenanted with gilt and scarlet chairs in which no one ever sits, or in similarly appointed waiting rooms to corporate offices (where oak and leather, steel and glass have replaced the simpering charm of fake French Empire).

Obviously, in each of these cases design decisions *have* been made, but unfortunately, they were wrong. In each case the designer has "worked up" a combina-

tion between his personal aesthetic, the desires of his clients, and whatever has been considered "good taste" at the consumer level. By working with a design team, checking conclusions through our six-sided function complex, and working closely with findings in the behavioral sciences, such mis-design could be avoided.

Change has always been with us, but the dimensions of this change are still not fully understood. As Alvin Toffler said in *Future Shock*, "We are now living through the second great divide in human history, comparable in size only with that first break in historic continuity—the shift from barbarism to civilization. . . ." Much has happened within the lifetimes of many of us that in sheer size is equalled only by man's entire previous life on this globe. Half of *all* the energy consumed by man during the past 2,000 years has been consumed within the last 100. The dividing line for many statistical series of materials (such as metals) seems to be about 1910. That is, man extracted about as much out of mines during the first 6 million years of his tenancy on this planet as during the last 60. The newspapers tell us that 25 per cent of all the people who ever lived are alive today; that 90 per cent of all the scientists and researchers who ever lived are living now; the amount of technical information doubles every 10 years; throughout the world about 100,000 journals are published in more than 60 languages, and this number doubles every 15 years. In the United States (a country notably exempt from the population explosion) the average density of people was one per square mile 200 years ago. In a circle 20 miles in diameter (assuming that 10 miles is the greatest distance a person can walk to work and back and still do a full day's work) this yields 314 persons inside the circle, with the rather obvious chance of human contact of 313 to one. Opportunities for interpersonal communication (the exchange of information and ideas) were formerly quite limited. Today, Chicago has a population density of 10,000 per square

mile, inside our 20-mile-diameter circle. Opportunities for human-to-human contact are more than 3 million to one.

Many of these changes are now setting a pace of their own, and are seemingly out of control. In Albert Romasco's *The Poverty of Abundance*, we find that: "In Ceylon, the introduction of DDT was largely responsible in less than 10 years for a 57 per cent decline in the death rate, a population increase of 83 per cent and a resultant decline in per capita income." He goes on to say, of the whole world, "There are nearly 300,000 babies born every day, two-thirds of them into families that are poor, hungry, ignorant, ill."

When we consider what a large population increase *does*, we find that it forces us into devising new ways of doing things because the old ones cannot work any more at all. A commission established in Tokyo to plan for the needs of a city of 20 million inhabitants within 10½ years soon found that *nothing in human experience, no technique adopted in the past, is relevant to the kind of problems that arise when one considers the future's population densities*. Within less than 15 years, several cities in India will have more than 36 million inhabitants each, and in the same time the United States will add more than 100 million people to its population. Within 35 years (present trends continuing) there will be close to 7 billion Africans, Asians, and Latin Americans, constituting 86 per cent of the world's population. "If your pulse beat is normal," says William Vogt, "it will not quite keep up with the increase in world population . . . Every time your pulse throbs, the population of the world has added more than one human being." It has taken mankind approximately 8 million years to reach a world population of 10 million people. It took another 12,000 years to reach the one-billion mark; 75 more years to reach 2 billion; 37 years to reach 3 billion; and within less than 18 years we shall have passed the 5-billion mark. Obviously, population growth

as a force for societal change has itself changed from a *quantitative* force to a *qualitative* one.

We are beginning to understand that the main challenge for our society no longer lies in the production of goods. Rather, we have to make choices that deal with "how good?" instead of "how much?" But the changes, and our awareness of these changes, are becoming so highly accelerated that trying to "make sense" of change itself will become our basic industry. Moral, aesthetic, and ethical values will evolve along with the choices to which they will be applied. We may still consider religion, sex, morality, the family structure, or medical research to be remote from technology and design. But the margin is narrowing fast.

With all these changes, the designer (as part of the multi-disciplinary, problem-solving team) can and must involve himself. He may *choose* to do so for vaguely humanitarian reasons (for maybe another 10 years or so in the Western world). Regardless of this, he will be *forced* to do so by the simple desire for survival within the not-too-distant future. When you try to tell people in our Western society that within a very short time, say 7 to 10 years, many of the people in the world will die of hunger, they simply do not hear. They give a little nervous laugh; a little embarrassed, they change the subject. But in Calcutta, Bombay, and New Delhi, thousands of bodies are already being removed by the sanitation squads each morning.

There was a time not very long ago, maybe in 1963, when, as William Paddock put it, "The stork passed the plow." And now people are increasing faster than the means of feeding them. Less food is available per person in the world today than during the Depression some 30 years ago. Population is now increasing over food production at the rate of 2:1 per year.

Food production and the development of new food sources have been of no interest to the design profession at all. Yet designers *are* involved, like it or not, as human beings. Raymond Ewell (editor of *Population Bulletin*) said a few years ago:

If present trends continue, it seems like that famine will reach serious proportions in India, Pakistan and China in the early 1970's, followed by Indonesia, Iran, Turkey, Egypt and several other countries within a few years, and then followed by most of the other countries of Asia, Africa and Latin America by 1980. Such a famine will be of massive proportions, affecting hundreds of millions, possibly even billions, of persons. If this happens, as appears likely, it will be the most colossal catastrophe in history.

All the "concern" over the growth of the world's people only thinly veils violence and a sort of "escapism." It is no longer considered "nice" to be a racist. But the specific words many of us use when we talk about the people in developing countries, slums, ghettos, are bad. *Their* populations "explode," we say. *They* are a "population bomb." *They* "breed like flies." We talk about "uncontrolled fertility" and how we must "teach *them* to control population" and we talk (especially regarding Africa, Asia, and Latin America) about "breeding swarms." Such words reflect our thinking. And such thinking is our inheritance of racism, prejudice, colonialism, white capitalist superiority and, when we begin to send "population control teams" to some country to "help," neo-colonialism.

Around 1800 there were an estimated 180 million inhabitants in Europe. The amount of people had increased to 450 million around 1900. But this fantastically increased population had a much higher living standard, ate better, dressed better, and lived longer than their own great-grandparents. The Malthusian Doctrine says: Food can *never* keep up with popula-

tion growth. But this simple formula has just two factors: soil and population. Science, design planning, research are completely left out. Malthus's theories may be applicable to animals (like laboratory rats), but the *one* function that is uniquely human, comprehensive anticipatory thinking and planning, changes his equation most drastically.

After all, only 90 years ago in the United States, a huge farm population (almost 75 per cent of the people) struggled desperately to keep a population of 85 million people from hunger. Today, *only 8 per cent of the population is still farming*, the population has surpassed the 200-million mark, and the biggest agricultural problem is what to do with megatons of food surplus each year! Agricultural machinery, irrigation, chemical fertilizers, scientific crop rotation, pest control, conservation, reforestation, selective breeding of stock animals—these are the fruits of science applied to Malthusian thinking, and they have destroyed his mechanistic concepts.

Naturally, families should not have more children that they can raise decently. *But birth control measures prove effective only after the living standards of the under-privileged have been raised.* That is the order: not the other way around. People begin to take interest in limiting the size of their families only *after* they are secure, have achieved human dignity and purpose, and are no longer beset by the anxiety and fears of hunger, poverty, ignorance, and disease. A large part of children born are no more than genetic insurance for people faced with the certainty of death for many of their children.

For hundreds of years we assumed what we were pleased to call "laziness" or languor, reduced energy, mental retardation, short life spans, and dullness to be racial characteristics in many underdeveloped countries. Today we know these are not races of lazy men; they are people chronically undernourished, to the point where they are no longer energetic and hopeful.

Malnutrition causes high infant death rates and often this occurs in families that have been made very large in the hopes of somehow compensating for this. But hunger and mental retardation go on, hand in hand.

The brain grows more rapidly than the rest of the body, its cells proliferating so quickly that by the time a child is four, the circumference of its head is 90 per cent as large as it ever will be. . . . This proliferation is almost entirely dependent on protein synthesis, which cannot take place in the absence of the essential amino acids which must be derived from food. (*Bioscience*, April 1967)

Producing basic agricultural implements for underdeveloped areas of the world brings less profit to industry than producing glittering consumer gadgets for abundant societies. Designing agricultural systems and tools is not thought of as a "glory job" or "fun" by most designers: how much more rewarding to "scale down" a 1931 Mercedes SS for fiberglass production, than to improve a plow for Pakistan!

The most significant gains in farming can be made through design and systems analysis. In order to support this thesis, I shall quote extensively from the "Famine 1975?" issue of the *Kaiser Aluminum News* * (from which most of the material cited above is derived). The headings of the pieces are: "Land," "Water," "Fertilizer," "Pesticides," "Preservation & Processing," "Livestock," "Mechanization," "Transport," "Marketing," and "Education." Each of these pieces is an input that fits and reinforces those around it.

None can be solved on an isolated basis. And no single sub-problem offers the final solution to world hunger, anymore than a single radio can be called

* "The World Food Crisis," *Kaiser Aluminum News*, Vol. 26, No. 1 (April 1968).

the answer to global communication. The world food crisis is a systems problem in which each part is amenable to solution, given the impetus of a sufficient political, social and economic commitment . . .

In many parts of Asia where water is critical, it would take 100 years to add one more cultivated acre per person. Meanwhile *the population will have increased 16 times*. If increase of cultivated land is to match population gains, then annual per capita expenditures in both water and land development must accelerate to more than 4 times the present level. Significantly improving crop yields is the only other alternative. But such double or triple cropping requires greater use of fertilizer, improved irrigation, and better pest control. The cost of bringing new land into cultivation varies widely, from \$973 per acre in Kenya to \$612 in the United States and \$32 at one pilot project in Guatemala. Assuming an average cost of \$375 per acre world-wide, the 4 billion arable acres remaining in the tropics alone would require an investment of \$1.5 trillion.

The land study reaches the following conclusion: ". . . since we don't yet have an accurate knowledge of what resources are at our disposal, a worldwide inventory of soil and water, as well as capital, manpower, and technology available, is a prior need."

In 1963 Bucky Fuller began a World Resources Inventory at Southern Illinois University, in Carbondale. This design study group has published 6 of some 10 planned reports. However, only a skeleton staff of 5 people remains to complete the work because designers, students, and design schools have shrugged off the entire matter as "dull," "uninteresting," and "unimportant."

If we study water, we find that less than 11 per cent of the world's cultivated land is irrigated. Part of the problem is lining ditches to control seepage, recycling water, and waste removal. In an earlier chapter I have already discussed the bad circulation system

of the African continent and tried to point out a few ways in which simple, hand-operated "pipe-making" tools might be used to help in irrigation and pollution at the village level.

Ground water estimated to be 3,000 times greater in quantity than the contents of all the world's rivers lies within half a drilling mile beneath the earth's surface. The Sahara Desert, for instance, contains 100 billion acre-feet of water in huge sub-surface aquifers; enough water to irrigate millions of acres for at least 4 centuries. To develop tapping, drilling, and distribution methods is a new design challenge. The desalination of ocean water is a process now in use in Israel. Rational design should make it possible to reduce costs.

Fertilization and pesticides and their influence on the environment have been discussed elsewhere. But it is in the area of preservation and processing of foods that designers could make a major contribution.

Food losses after harvest run as high as 80% in the diet deficient countries, due largely to poor storage and processing. Micro-organisms, insects and rodents are the main cause of food loss after harvest. Rats consume 16 times more food than humans per body weight; in India rats eat 30% of stored grains; in some countries as much as 60%. One-third of all harvested cereals in Africa is lost to rodents. Because of poor and out-dated equipment, lack of refrigeration and inefficient transport, 50% of marketed fruits and vegetables are lost in the hungry nations, where most perishables must be eaten within 24 hours of harvest.

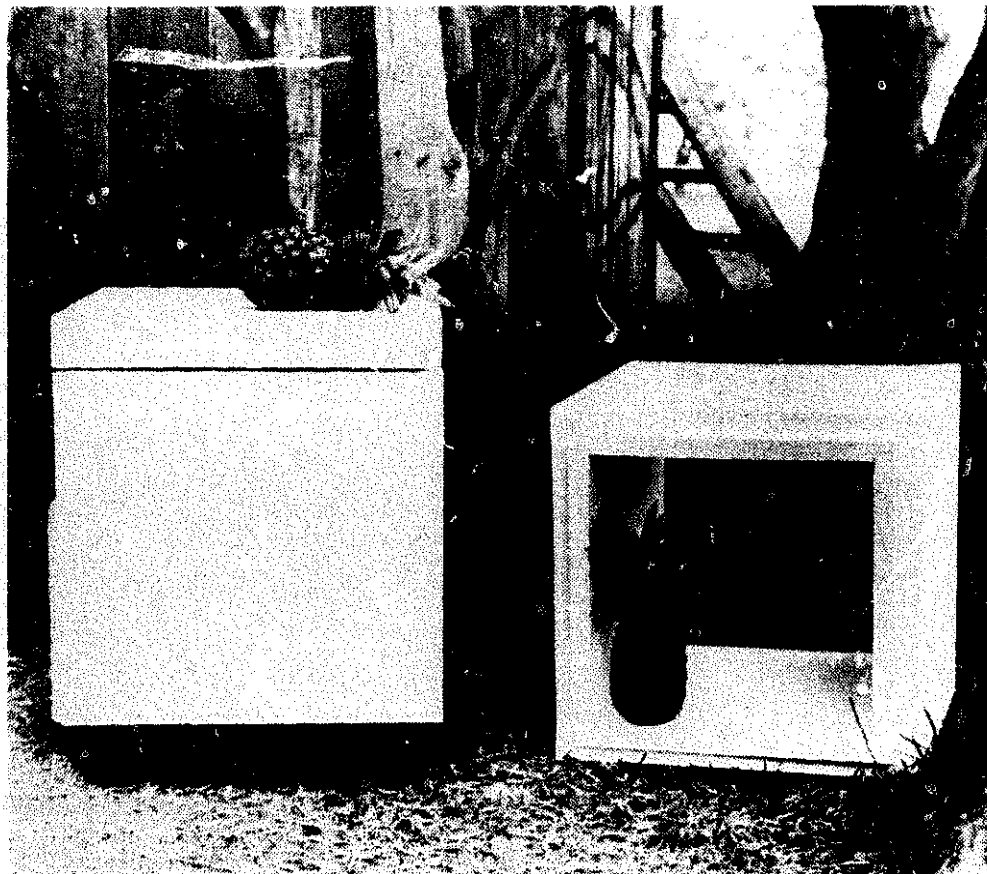
There is little under "livestock" that relates directly to the work of designers. But at present, livestock is a highly inefficient and costly way of obtaining proteins. Here the development and production of "single-cell proteins" will provide the breakthroughs. The production and equipment for the laboratory farm-

ing of protein bacteria is well within the design team's area of concern. Benefits are dramatic:

The full potential of protein bacteria is easier to grasp if it is compared with a properly-fed 1,000 pound steer. The steer stores up just one pound of protein a day. In the same 24 hours, a half ton of selected micro-organisms, feeding on oil, increase in size and weight by five times, and half this gain is useful protein. In other words, *while the steer is making one pound of protein, the bacteria-in-oil produces 2,500 pounds of protein.* (Professor Alfred Champagnat)

The present cost of this protein, because of an insuffi-

A modular cooling unit for perishable foods, to be used in under-developed countries. The unit is hand-cranked and can be made for under \$6. Designed for UNESCO by James Hennessey and Victor Papanek.



cient state-of-the-art and badly designed equipment, is about 20¢ per pound. As to the taste:

The line of meatlike but meatless foods includes ham, sausage, frankfurters, fried chicken, steaks, meatloaf, chipped beef and luncheon loaves. They have no bones, skin or excess fat . . . surprisingly, most of these rated high both in taste and appearance. (*Successful Farming*, October 1967)

Mechanization is the next one of our puzzle pieces. Studies have shown that to get high crop yields, mechanical energy of about .5 horsepower is needed for every 2½ acres of land. In the United States and in Europe, the energy level is more than twice that. But in the hungry nations it is very low: less than .3 horsepower in Latin America, under .2 in Asia, and only .05 in Africa. The Kaiser report concludes: “. . . the most difficult task would be recruiting and training the 10,000 designers needed. . . .” In this connection it is worth noting that, of the 692 “professional” members of the Industrial Designers Society of America (the *only* professional design group), only 18 are involved in the design of farm machinery. Twelve of these are producing mini-tractors and ride-em-yourself lawn mowers with which the rich manicure their lawns. Only the remaining 6 are involved with prime producers of farm machinery. And even their involvement consists largely of surface styling, trademark design, sexy promotion gimmicks, and more comfortable tractor seats.

Transport seems least efficient where it is most needed. In India alone more than half a million villages are more than 5 miles from a road, and many of these roads are not passable in bad weather. One alternative to the costly development of the road networks and vehicles would be the development and wide distribution of ground effect vehicles that would make roads unnecessary (but would not be powered by internal combustion engines).

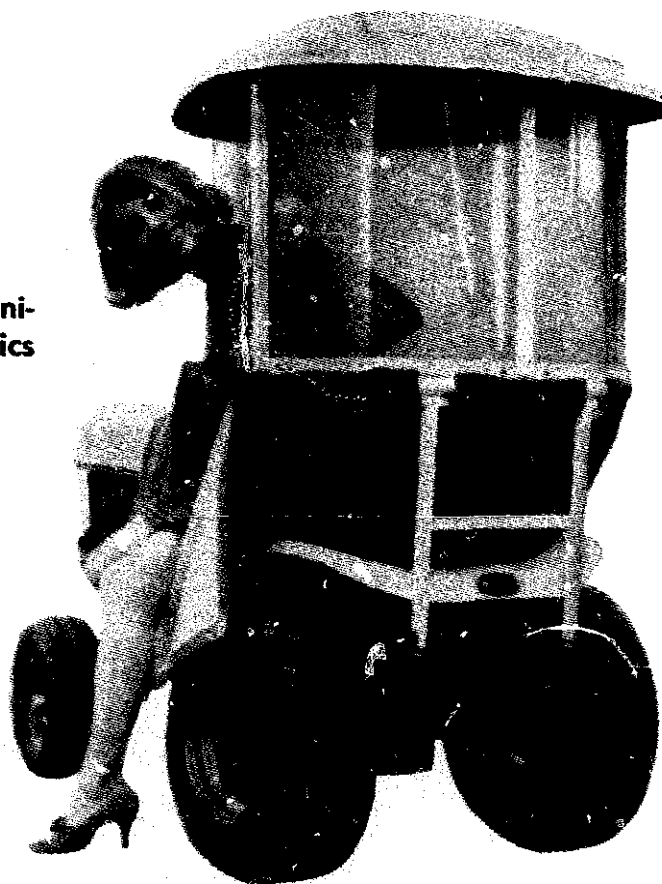
Note: the only ground effect vehicles now in operation are either designed to transport tourists and their automobiles across the English Channel, or else are being used by the United States Army to napalm people and villages in the Mekong Delta.

It is of additional interest to compare the genesis, development, and marketing of a relatively new consumer product. Beginning in the mid-sixties, firms in the United States, Sweden, West Germany, and a few other countries began introducing a series of gasoline-powered sleds on the market. These "snowmobiles" are largely bought and used in winter sports areas. They sell almost exclusively to wealthy and jaded young "athletes" whom these zippy little gadgets enable to traverse snow-covered terrain in "easy-chair comfort" with mechanical heaters helping them to "rough it." These self-propelled power scooters currently sell for approximately \$995. Snowmobile clubs and rallies have been organized to help with the sale of these vehicles, and by now an attractive range of extra accessories (built-in tape decks, two-way radios, trailers, etc.) are available to the "discerning consumer." However, a new need has made itself manifest.

Rural populations in Canada and Finland, Lapp populations of Norway and Sweden, and the people living in the polar regions of the Soviet Union have found that vehicles of this type are useful in hunting, fishing, herding reindeer, and for emergency transportation needs. Surely here is an area in which industrial designers could work with their traditional values of cost reduction and mass production. Such a vehicle, selling for around \$100 or less, would provide a new working tool for a large number of people now living under marginal conditions. Instead, snowmobiles are becoming more complex, more loaded with consumer values and still higher in cost.

A student design team of mine is now attempting to develop and build a first prototype of a low-cost, battery-driven snowmobile, specially designed for the needs of the Eskimos, Northwest Coast Indians, and

Advertisement for a Mini-tractor, by the Plastics Division of Kodak.



Lapps. Before starting on the project, we discussed it with relevant sectors of American industry who dismissed the entire approach as impractical, silly, and "not needed." We shall also attempt to make our scooter nearly noiseless and free from polluting agents.

"Education" forms the concluding part of the Kaiser Report. A country's agricultural development is related directly to a rising level in general education among its people. In developing countries there are $\frac{3}{4}$ of a billion illiterate people. The fact that there are 20 million *more* illiterates in these countries today than there were only 5 years ago shows the inadequacy of educational efforts. My own low-cost transistor radio, pictured and described elsewhere in this book, serves as a good example of how one small, somewhat "gadgety" device may become a link in a total educational system and thereby transcend the narrow role it was originally designed for.

It is criminal that at present no area of design for agriculture forms even a small part of any curriculum of design taught at even one school anywhere! Instead of addressing themselves to such environmental needs, the industrial design schools are making a concerted effort to teach design for settings far more exotic.

During the spring of 1969, six leading American design schools were involved in a competition and exhibit to design housing and working environments for the ocean floor. The heavy publicity surrounding these endeavors was nearly drowned out by another program which concerned itself with the design of an entertainment center to be erected on the moon. There is little doubt that soon men will have to harvest the protein-rich fields that are the world's oceans. Nor will it be long before we drill for minerals and oil on ocean floors and farm the fish and algae of the seas. And certainly before the end of this century men will look to the stars while living in semi-permanent domed settlements on the moon. But the necessities of today cannot be neglected for the expediencies of some dubious tomorrow. Design competitions such as the two mentioned above are usually assigned because they are more glamorous, "glory jobs," more *fun* than coming to grips with real problems. It is also in the interest of the Establishment to provide science-fiction routes of escape for the young, lest they become aware of the harshness of what is real.

Designs will be needed when man establishes himself on our ocean floors and on planets circling distant suns. But man's leap to the stars and his life beneath the seas is heavily conditioned by the environment we create here and now. There is something wrong when young people are less familiar with life on a southern Appalachian farm than with the construction of a gambling casino on Mars. They are taught a lie when they find themselves more familiar with atmospheric pressures in the Mindanao Deep than with atmospheric pollution over Detroit.

11 THE NEON BLACKBOARD:

The Education of Designers and the Construction of Integrated Design Teams

Telling lies to the young is wrong.
Proving to them that lies are true is wrong.
The young know what you mean. The young are people.
Tell them the difficulties can't be counted,
And let them see not only what will be
But see with clarity these present times.

—YEVGENY YEVTUSHENKO

Education for designers (like nearly all education) is based on the learning of skills and the acquisition of a philosophy. It is unfortunate that in our design schools both of these are wrong. The skills we teach are too often related to processes and working methods of an age just coming to a close. The philosophy is an equal mixture of the kind of self-expressive bohemian individualism best expressed in *la vie bohème* and a profit-oriented, brutal commercialism. Moreover, at best the "method" of transmitting all this is almost half a century old.

In 1929 the Albert Langen Verlag of Munich published the book *Von Material zu Architektur* by László Moholy-Nagy as Volume 14 for the Bauhaus. Moholy-Nagy attempted to find new ways of involving young people with the interface between technology and design, design and the crafts, design and art. Possibly the most important idea was to have students experi-

ment directly with tools, machines, and materials. Technological development did not end with the electric band-saw sheltered in some Bauhaus basement in 1919. To base education on this kind of development is to ignore data-processing, computer technology, remote handling mechanisms, jet airplanes, space research: in fact all that science and research have developed for mankind in this, their most productive half century.

When Moholy-Nagy started the "New Bauhaus" (later the Institute of Design) in Chicago, the book was republished (by Norton in 1938) under the title *The New Vision*. An expanded and lavishly illustrated rehash of all this was brought out shortly after Moholy-Nagy's death under the title *Vision in Motion* in 1947. And now, nearly a quarter of a century later, this 1947 re-hash of a 1938 translation of a 1929 book describing design experiments carried on in 1919 still forms the basic design curriculum at nearly all American and European schools. Happily, experiment turned into tradition marches into the second half of the century. Can we wonder that students are bored? Can we wonder that our young people no longer consider the university and its courses relevant to living? Surely a student entering a design school or university in September of, say, 1971, must be educated to operate effectively in a professional world *starting* in 1976, and foreseeably he will reach the height of his professional competence in 1995, or the year 2000.

Learning must be an ecstatic experience, as George B. Leonard maintains in *Education and Ecstasy*. At best, for instance, learning to drive a car is ecstatic (as any sixteen-year-old will tell you). To drive an automobile demands a fantastic combination of motor coordination, physiological, and psychological skills. Watch the thousands of people driving along the Los Angeles Freeway at 5:00 P.M. any afternoon. People controlling 2 tons of steel and machinery, hurtling along at better than 60 miles per hour, with the distances between cars to be measured in inches. It is an

impressive performance. It is a *learned* skill. And it just possibly may be the most highly structured non-instinctual activity these drivers engage in in their entire lives. They drive superbly well; the clue to their performance lies in the original method of learning how to drive. For to learn is to change. Education is a process in which the environment changes the learner, and the learner changes the environment. In other words, both are *interactive*. Both the beginning driver and his car, as well as road system, other cars, and his teacher, are locked into a self-regenerating system in which each slight perfection of every slight skill is immediately rewarded or positively reinforced. To return to George B. Leonard (on page 39 in *Education and Ecstasy*):

No environment can strongly affect a person unless it is strongly interactive. To be interactive, the environment must be responsive, that is, must provide relevant feedback to the learner. For the feedback to be relevant, it must meet the learner *where he is*, then program (that is, change in appropriate steps at appropriate times) as he changes. The learner changes (that is, is educated) through his responses to the environment.

Unfortunately, education has been made into a method of preserving the status quo, a way of teaching and maintaining the moral attitudes, smug life-styles, and other sacrosanct values held by the old, and dispensing whatever is currently accepted as "Truth."

Digressing for a moment, we find that the example of learning to drive an automobile, cited above, is really just a scale model of how mankind as a whole has learned to live. For through millions of years man was a hunter, a fisherman, a sailor-navigator. As a hunter, he roamed earth as a member of a small hunting party—a cross-disciplinary team, in a way. He evolved early (but elegantly functional) tools: evidence from Choukoutien in China shows that Peking Man (*Pithecanthropus pekinensis*) fashioned stone

tools long before *Homo sapiens* appeared on earth, and used fire as well.

Man as a hunter-fisherman-sailor was a non-specialist or a generalist, whose brain furnished him with that social understanding and control of casual impulses needed in a hunting group or society. We are told that even language evolved in answer to group need in the hunting party.

As hunter, man was highly successful. Equipped with spear-thrower, slingshot, and bow, with knives superbly crafted of obsidian, horn, or bone, he spread from Siberia to Spain and from the ice cliffs of Afghanistan to Mesopotamia. And adventuresome early hunters followed bison and mammoth across the frozen Bering Strait into North America, where they settled the Great Plains nearly 15,000 years ago. They were *Homo sapiens*, and they were hunters. *Farmers would never have survived.* Even the art works of the Upper Paleolithic are evidence of a fairly leisurely existence and, in Europe at least, life may have been quite pleasant for these hunters.

I am not suggesting the hunter as a "noble savage" *à la Rousseau*. Compared with his farmer-descendant of the Neolithic, he may have been a rough, nearly savage fellow. Yet as we study Paleolithic archaeology or read about and live with the disappearing tribes still essentially Paleolithic today (the Bushmen of the Kalahari, the Australian aborigine or the Eskimo), we see much that is ingenious and admirable.

To quote from Nigel Calder's *The Environment Game*:

How do you deal with an angry bull elephant, when all you have is a sharpened stone? You nip aside, slip in behind, and cut the tendons of his heel. What can you do to lure a giraffe, the most timid of large animals? You play on its curiosity for bright objects by flashing a polished stone in its direction. The Bushmen, according to Laurens Van der Post, would use lions as hunting "dogs," letting them kill game and eat a little, before driving them off with fire.

Franz Boas tells how Eskimo approach deer, two men together, one stooping behind like the back end of a pantomime horse, the other carrying his bow on his shoulders to resemble antlers and grunting like a deer. The despised Australian aborigine can "travel light" with only a few wooden and stone implements and, by his knowledge of nature, survive indefinitely in the Great Sandy Desert. If we once let these echoes of our pre-history penetrate our sophisticated heads, they strike in us chords of excitement, if not of envy.

Traditionally we are taught to see farming as the prerequisite of civilization. An elaborate social life, we have been told, could not develop until man was freed from the daily chore of fishing or hunting. Lately however, this theory is being challenged by the view that early civilized settlements were based on highly organized food gathering rather than cultivation. The highly structured societies of American Indians and the salmon-eaters of British Columbia were so well supplied with food that large settlements developed.

To return to Nigel Calder in *The Environment Game*:

Man's chief physical disadvantage as a hunter must have been the encumbrance of his family. The human infant is uniquely helpless and slow to mature. Accordingly, a fairly settled, well-defended domestic life was necessary from the outset. Women at home minding the children while the men were out hunting were well placed to develop arts like cooking, clothes-making, and pottery, to experiment with new foods, and to discover in their "gardens" the elementary principles of plant reproduction. Jacquetta Hawkes has remarked, "It is tempting to be convinced that the earliest Neolithic societies gave woman the highest status she has ever known." (*Pre-history*, UNESCO History of Mankind)

In truth it was agriculture that turned man towards the fateful downward slope of specialization.

Mankind, heretofore dynamically moving through the environment as a member of a non-specialized, cross-disciplinary hunting party, now settled down to patient, millennia-long cultivation of the soil. Instead of learning through interaction with the environment, he substituted eons of boredom and elevated tradition to wisdom; hence to be conservative was a virtue. With human settlements located in prime agricultural areas, natural disasters became major destructors of the social pattern. Zealous and vengeful gods had to be appeased through priestly classes, sacrifices, and rituals. Man no longer stood and fought his surround alone, moving freely across the globe. Instead, territory became precious and war an extension of statecraft.

As Buckminster Fuller has said, every living creature is more specialized than man. Most birds can fly beautifully, but find it almost impossible to walk. Pigeons can do a little better at walking than most other birds, and the robin can hop. But most birds can't begin to walk at all. Fish swim beautifully, and get along in their medium, but they can't walk and (usually) can't get out on the land. These are all highly specialized forms of life. What is absolutely unique about man is his ability to apprehend, comprehend, and employ information, and to undertake unprecedented tasks.

For millions of years man's "little red schoolhouse" was earth itself. Mankind was taught to react and to behave by the environment, disasters, and predators. But now we have replaced our "natural enemies" with *educators*, and we try to learn from them. To brutally twist man away from his natural heritage of non-specialization in this way can only have brutal results. It is in the area of driving men into ever-narrowing fields of specialization that the schools and universities have made their greatest mistakes. Today's "revolution on the campus" is the students' intuitive reaction.

Modern technology (computers, automation, mass production, mass communication, high-speed travel,

etc.) is beginning to give mankind a chance to return to the interactive learning experience, the sensory awakening of the early hunter. Hydroponic farming, "fish-herding," protein manufacture, and skyscraper farms will help also. Education can once again become relevant to a society of *generalists*, in other words, designer-planners. We have established in the first chapter that designers (especially) must operate on a non-specialized basis; it is little wonder, then, that the intuitive student revolution against "status quo education" seems often to happen first in our schools of design. For the designer shapes the environments in which we all live, the tools which we all use. And from the unpalatable manifestations of bad design in our society, the design student cannot remain aloof for long.

The main trouble with design schools seems to be that they teach too much design and not enough about the social, economic, and political environment in which design takes place. It is impossible to teach anything *in vacuo*, least of all in a system as deeply involved with man's basic needs as we have seen design to be.

To this dichotomy between the real world and the word of the school, there have been, understandably, many different answers.

After all, students could argue that, inasmuch as we have succeeded (nationally) in the murder, rape, torture, pillage, and genocide of some 60 million Indians; and as the nations of the world have succeeded (internationally) in murdering, napalming, atomizing, and maiming some 150 million people *during the last 54 years alone*; and as another 600 million men, women, and children (one sixth of humanity) are starving to death, or dying of easily curable diseases within this decade; that somewhere *we* (the designers of our environments, our tools, and our products) have been missing the boat.

Yet the designers' "responsible" answers to such

crises (last year alone) have consisted in such trivia as a \$3,000, 14-carat gold toilet seat, appetizingly advertised in the newspapers of La Jolla, California, a wall-to-wall bathroom rug made of monkey fur and selling for \$12,800, and finally, for the economy-minded, that life-sized, inflatable plastic woman at \$9.95, or \$16.95 for the deluxe model (see the advertisement in *Argosy*, February 1969, page 93; as well as Chapter Six of this volume).

In a foundation-endowed society (with the "Universal Credit Card" just months away), the foregoing smacks of heresy. Why, aren't our think-tanks thinking about the unthinkable? Don't we produce the finest artificial grass? Aren't our fiberglass rocks (hollow, for easier moving) the envy of the Free World?

Well, what *is* the position of design in the West today? We know that the twin concepts of "designed aesthetics" and "designed obsolescence" are heavily interrelated, and this connection becomes very apparent both in basic research and in the manufacturing process. Objects are designed, made, and purchased in a variety of styles. A French Provincial TV set, a Baroque refrigerator, or an "Early American" skyscraper strikes few consumers, or for that matter even designers, as anachronistic and silly. Even within the narrow band of "modern" or "contemporary," many different stylistic approaches exist and are accepted by the public. The clear direction of the past has changed into erratic and random fragmentation.

One cause of this fragmentation lies in our economic processes. Consumer goods of every sort, including houses, apartment buildings, civic centers, and motels, must seem continuously new. For we buy or rent only that which is changed and, moreover, *looks* changed. Industry, hand-in-hand with advertising and marketing, teaches us to look for and recognize these superficial changes, to expect them, and, ultimately, to demand them. Real changes—basic changes—mean retooling or rebuilding; in our present system the costs

of this are prohibitively high. But to repaint and/or rearrange surfaces (interior or exterior) is just as exciting to the propagandized lay public, and can be done more cheaply.

Thus, the vital working parts of a mechanism (the guts of a toaster, for instance) will remain unchanged for years while surface finish, exterior embellishments, control mechanisms, and skin color and texture undergo yearly mutations. This will hold true even if the working part is far from perfect or in fact has major weaknesses or faults (as in the case of automobiles, motor boats, air-conditioners, refrigerators, or washing machines). Automation also tends to make periodic re-evaluation of the real design problems prohibitively expensive. The regional planner has become a landscape designer, the architect a decorator, and the designer a stylist or cosmetician. Mechanism and structure are relegated to the appropriate engineer and the product lacks all unity or wholeness of purpose.

Accidentally, even the lowly stylist may strike some common associational or telesic chord that makes the consumer wish to hold on to the product, rather than trade it in for the latest version. (Recent examples of this are the 1961 Mustang and the 1954 Porsche.) To break down even this accidental unwillingness on the part of the consumer to throw away things, we have evolved materials that age badly. Throughout most of human history, materials, being organic, have aged gracefully. Thatched roofs, wooden furniture, copper kettles, leather aprons, ceramic bowls—all these and more would acquire small nicks, scratches, and dents, gently discolor and acquire a thin patina as part of the natural process of oxidation. Ultimately, they would disintegrate into their organic components. Today we are taught that ageing (be it of products or individuals) is subtly wrong. We wear, use, enjoy things as long as they look as if they had just been bought. But once, under sunlight, the plastic bucket deforms (however slightly), once the fake walnut table-top melts under a cigarette, the anodizing on

an aluminum tumbler slips, we are taught to throw the offending object out.

This divorce between the working mechanism (which, because of tool and die-making costs, remains unchanged) and the more and more evanescent skin surface has led to further specialization and to an aesthetic based on outward appearance only. The "skin" designers (Detroit's stylists) disdainfully avoid the "guts" designers (engineers and research people); form and function are split. But neither a creature nor a product can survive for long when its skin and guts are separate. Finally, basic design research seems unsound because of the huge effort needed to keep up with a rapid technology. The knowledge and care which the product itself demands are diverted.

A more durable kind of design thinking sees the product (or tool, or transportation device, or building, or city) as a linear link between man and his environment. In reality we must think of man, his means, his environment, and his ways of thinking about, planning for, and manipulating himself and his surround as a non-linear, simultaneous, integrated, comprehensive whole.

This approach is *integrated design*. It deals with the *specialized* extensions of man that make it possible for him to remain a *generalist*. Such means and extensions already exist, but if we wish to relate the human environment to the psychophysical wholeness of the human being, we have to develop new, modified, and growing extensions and means on several new planes. Our goal would be to replan and redesign both function and structure of all the tools, products, shelters, and settlements of man into an integrated living environment, an environment capable of growth, change, mutation, adaptation, regeneration, in response to man's needs.

All man's functions—breathing, balancing, walking, perceiving, consuming, symbol-making, society-generating—are completely interrelated and interdependent.

Integrated design will concern itself, for the first time since the Late Paleolithic, with *unity*. This must include regional and city planning, architecture (both interior and exterior), industrial design (including systems analysis, transportation and bionic research), product design (including clothing), packaging, and all the graphic and film-making skills that can be generally subsumed under the catch-all phrase of visual design. Dividing lines exist between these areas at present, but the lunacy of these divisions is apparent even on the most basic level. To use one example: What is architecture? Assuredly it is more than the skill of building arches. Considering today's mix of civil engineering, speculative building, contracting, interior decoration, federally subsidized mass housing, landscaping, regional planning, rural and urban sociology, sculpture, and industrial design, can architecture even be said to exist as a separate discipline at all?

Certainly the "formal" grammar of building types can be said to have been enlarged greatly during the last 50 years. Nervi and Catalano have given us new ways of dealing with pre-stressed and reinforced concrete shells. Jim Fitzgibbon and Bucky Fuller have given us Synergetics, Geodesics, the Dymaxion House, and the dome. Bruce Goff and Herb Greene in the United States have developed a whole new concept of indigenous building. Bill Katavolos and I have both played with theoretical methods of *literally growing buildings organically*. But none of this has really enriched the field of architecture—whatever that may be. For we are able to compute almost exactly the wind forces operating against Herb Greene's Prairie Houses and define weight-to-cost ratio in a Bucky Fuller dome, but we have done little or no basic research assessing in what kind of a structure the human organism lives, works, interacts optimally. There is not enough knowledge regarding some of the most fundamental aspects of architecture.

In other ways, architecture can hardly still be considered an area of its own (it lacks definition), and,

finally, it overlaps with dozens of different fields. In view of all this, what is architecture? Could this be the reason why so many architects have moved towards city planning and industrial design during the last decade? And during that same time, industrial designers have concerned themselves increasingly with the development of prefabricated houses and building components. Interior designers have developed furniture, tools, and are currently caught up in the fad of "Super Graphics" while visual designers develop products and make films.

There is a sort of Brownian motion going on throughout all the separate areas of design, and I believe this to be an intuitive response to dynamically changing times, similar to the intuitive dissatisfaction and unrest of students. Surely it would be more rational to say that within the field of integrated design, many different levels of complexity exist. These might concern themselves with the relationship of human and structural factors in a material (or a set of materials) that provides shelter or with the interaction between a transportation device, a road network, and the landscape.

If we speak of integrated design, of design-as-a-whole, of unity, we need designers able to deal with the design process comprehensively. Lamentably, students so equipped are not yet turned out by any school. For their education will be less specialized and take onto itself many new disciplines now thought of as only distantly related to design, if related at all.

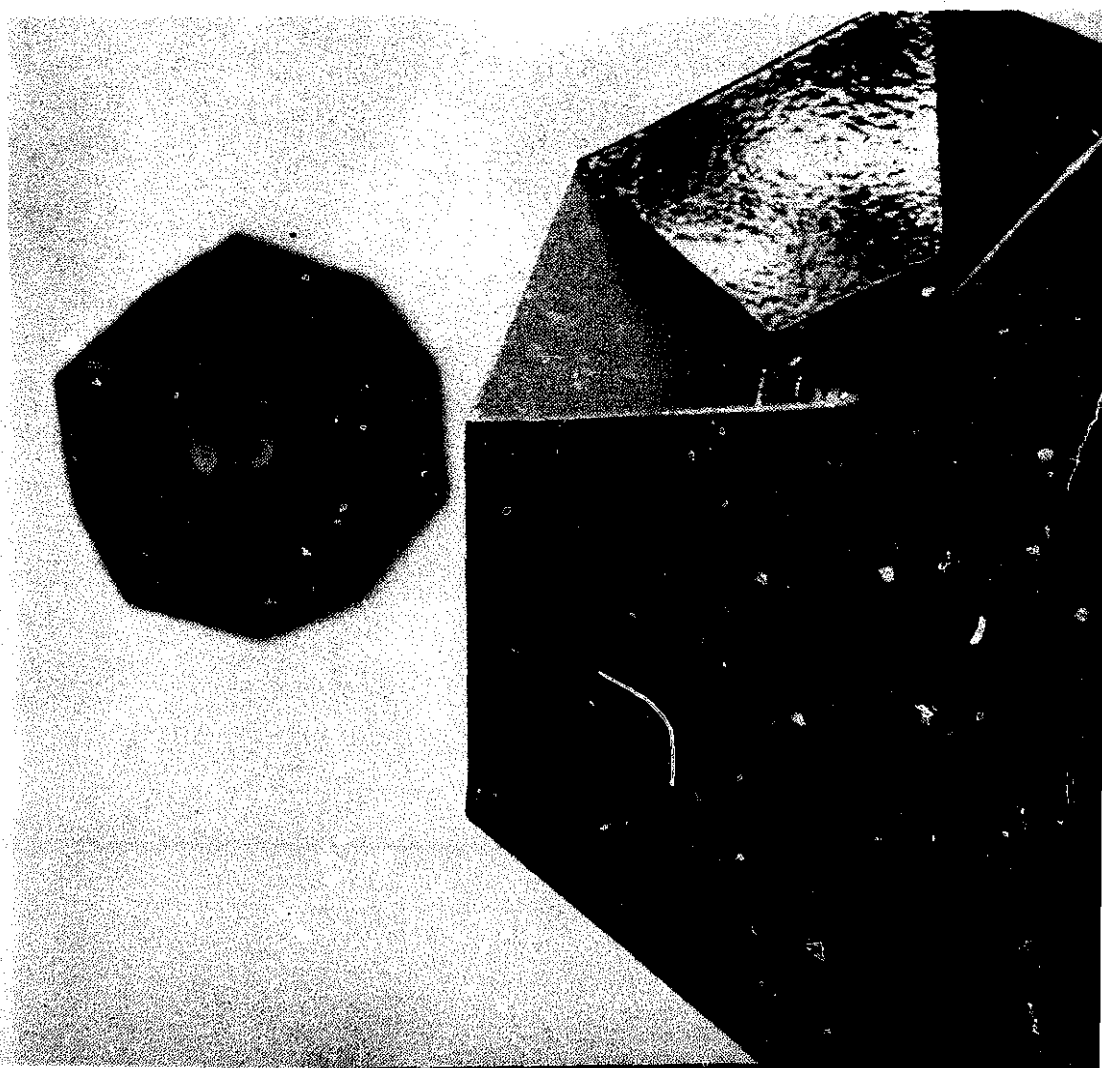
Integrated design is not a set of skills, techniques, or mechanical processes, but should be thought of as a series of biological functions occurring simultaneously rather than in a linear sequence. These simultaneous "events" can be thought of as initial fertilization, developmental growth, production (or mimesis), and evaluation, the latter leading to re-initiation or regeneration or both, thus forming a closed feedback loop.

Integrated design (a general unified design system)

demands that, through careful analysis, we establish at what level of complexity the problem belongs. Are we, for instance, dealing with a tool that must be redesigned, or are we dealing with a manufacturing method in which up to now this tool has been used, or should we rethink the product itself in relation to its ultimate purpose? Answers to questions like these do not yield to "seat-of-the-pants" examination.

A second area of investigation (unavoidably entwined with the previous one) is the historical perspective of the problem. All that we design is an extension of the human being (usually from generalization to specialization). While a high-fidelity system,

Experimental configuration of high-fidelity speakers, based on the dodecahedron. "Ideal" sound cones happen to follow the continuation of planes extending the edges of a dodecahedron. This design uses twelve 93-cent speakers; two such speaker clusters give the stereo equivalent of a system costing ten times as much. Author's design.



for instance, may be loaded with associational values and carry a great deal of status, basically it is an extension of the human ear. As we have seen in our six-sided function complex (Chapter One), all design must fill a human need. The history of man's emphasizing or de-emphasizing particular needs and how they have been met is vital to the understanding and initiation of new products or systems serving these needs. Furthermore, such needs will be re-examined and re-grouped with other needs or systems as the culture changes. Thus when the human, historical coordinates of an idea are found, certain principles can be applied to find out what particular phase of the idea we are dealing with.

Another consideration must be that of human factors. If we assume that all design is an extension of man (either good or bad), the relevance of humane values is obvious. Any design, on this level of consideration, is an organic substitution or implant (much like a transplanted heart, an artificial kidney, contact lenses, or a prosthetic hand). As such it must be recognizable and usable not only by the so-called "five senses," but also by the inner senses, both psychological and kinesthetic. Furthermore we must recognize the artificiality of this divorce between outer perceptions and the inner responses in man, for it gravely jeopardizes any unified human factors study.

Next, in integrated design we must attempt to place the problem in its social perspective. We have paid lip service to the concept that the entire factory system and automation (both are, as of this writing, supreme extensions of man) will result in making all that we feel we need available without effort, to all people, in all places, and at all times. But as our living patterns (and what we now think of as needs) change radically, the ultimate consumer values may no longer be "availability" and "effortlessness." Taking the long view, we can see that our attempts to remove all of our activities from the manual to the mechanical and then to the automatic indiscriminately may be quite

wrong, as we have seen in examining the automobile vis-à-vis our "Triad of Limitations" in an earlier chapter. Chronically, we have failed to distinguish the means from the ends, and we have made mechanical what should have remained manual, and have made automatic that which might have been more rationally replaced with an entirely different system. A good example of such wasted energy is the automatic gear shift. The actual energy expended by the driver when shifting gears is incomparably smaller than the energy expended in manufacturing the automatic shift, not to mention the energy required to supply the factory and the automobile with the additional raw materials and man-hours required to make it. To quote Bob Malone (in an unpublished paper from 1957) on this:

Is the automatic gear shift then a true advance in humane design or not? Since it tends to *remove* man from a basic and relatively simple use of his motor responses, rather than to simplify and integrate the processes, we can see that the validity of the automatic gear shift is illusory. When a true need or desire is satisfied for a passive human being without effort, the result is not gratification, but rather a more complex level of dissatisfaction. The man caught helplessly in a natural catastrophe has good reasons to think about human dignity and to wish that the material necessities of his life could be met more simply.

Another level of social consideration in integrated design must consider social groups, classes, and societies. Much design must be re-examined to see how far it may perpetuate class systems and social status. As more and more methods of social classification, stratification, and class identity break down, there is a ready market for products used to express social ambition and strivings for status.

Cassette-type tape recorders now come in nearly 40 models. All of these are battery-powered (with optional power cords); they all use the same interchangeable

tape cassettes, are nearly identical in size and weight, possess identical "guts" (often several different brand names are manufactured in the same factory, like aspirin). . . . The casing (or "skin") of these recorders is the identical black, or sometimes gray, plastic; they have the same number of control knobs; name plates are in identical positions, and they all are sold in nearly identical black "leatherette" carrying cases. Nonetheless, they are priced from \$22.95 to \$149.50 (with 15 price-breaks in between) and, what is more surprising, are selling well in all price ranges.

Stylist-designers help to maintain present-day divisions between various income levels in a consumer society. By pooling present "state-of-the-art" knowledge regarding cassette-type tape recorders and manufacturing just *one* optimally useful type, it should be possible to reduce costs to a retail level of about \$9, and thus make possible a number of breakthroughs: magazines could be "published," letters "written," and education conducted—all on tapes that everybody could afford.

An opposite example is *trätöflor*, leather and wood slipper-shoes made in Ängelholm, Sweden. This footwear can be worn both at home and (with casual dress) on the street. They sell for about \$4 a pair in Sweden. The upper part is made of cowhide; last and heel are shaped of wood. The soles are rubber. All three materials age well. These slipper-shoes are orthopedically beneficial to the foot as well as comfortable. They have a life expectancy of at least 4 years, can be worn in every kind of weather and, being nearly identical, cut completely across social and income classes, conveying no idea of status. (It is interesting to note in this connection that, of late, *trätöflor* are being made in a variety of textures, colors, and artificial materials. This makes them tend to wear out faster; repairs are more difficult and sometimes impossible.) They constitute, *in their original form*, a superb example of indigenous, non-manipulated design. Several brands of *trätöflor* have recently become popu-



Trätofflor, still made in Ängelholm, Sweden, are a superb example of rational, vernacular design.

lar in the United States where they became known as "Swedish clogs" and sold at higher prices.

Part of the philosophical and moral bankruptcy of universities and design schools lies in their ever-increasing trend to train students to become narrowly "vertical" specialists whereas the real need is for broad, "horizontal" generalists or synthesists. Nearly everything in today's university milieu militates against educating for general synthesis. Prerequisite courses, co-required courses, "required electives," and empire-building by deans and professors with their own vested interests at stake make education for a broader future nearly impossible. When we remember that the price which a species pays for specialization usually is extinction, this becomes even more criminal. George B. Leonard and I seem united in our feeling that most of what passes for "education" today is in reality a "crime against humanity" as defined by the Nuremberg Laws of 1945, and that most educators could be imprisoned for violating at least 6 of the 10 points of this same code for experimenting upon human beings—without their consent, without the subject's right to terminate experimentation, without the subject's right to change his conditions, for engaging in torture, etc., etc. It is to

the credit of the young people of today that they have smelled all of this out and are trying to change it.

Ideally, of course, groups of concerned young people of all ages would meet together to engage in design. This would mean to learn, study, teach one another, experiment, engage in research and discussion, and interact with one another and with people from disciplines not generally subsumed under the heading of design. Such a group would be small (30 to 50 in number), and its members might stay together for weeks, months, or even years. Individual team members or small groups might, at will, detach themselves from the group, traveling or working directly with other groups or with manufacturing systems. Computer-assisted learning programs, as well as computer-assisted data acquisition, storage, and retrieval would of course be available to all members of the team.

But it is probably more meaningful to determine what can be done right now and in the immediate future.

In establishing a 5-year undergraduate curriculum for industrial and environmental design (at Purdue University), I took care that each student's program of study consisted of as free and broad a mix as was possible. We attempted to break down the false dividing lines between the various specialized fields of design such as visual design, interior design, industrial design, etc. Part of this was also training with twentieth-century tools of communication and expression such as computer sciences, photography, kinetics, cybernetics, electronics, and film-making. In addition to exploring verbal, visual, and technological methods of transmitting information, the students were encouraged to participate in other disciplines of concern to integrated comprehensive design. Thus sociology, anthropology, psychology (perception, human engineering factors, ergonomics), and, in fact, all the behavioral sciences were stressed. Because both individual human beings and social groups are biologically functional, the so-called life sciences must be a keystone in the

study of systems, forms, structures, and processes. Hence, a study of chemistry, physics, statics, and dynamics was more than augmented by work in structural biology, ecology, and ethology. This led to courses in theoretical and applied bionics and biomechanics (cf.: Chapter Nine). Finally, nearly one third of all undergraduate time was left open for entirely free electives, which meant in practice that a student could assemble a "minor" in some area that was of concern to him such as anthropology or political science.

It is unfortunate that almost all schools or departments of design in the United States require an undergraduate degree in the same field as that in which the student hopes to do graduate work. We chose a different way, because of our passionate belief that the true design needs of the world must be carried out by cross-disciplinary teams. Hence for graduate work we did not require 4 or 5 previous years of study in industrial design, architecture, or some other design area, but preferred taking our young people from the field of behavioral sciences. This added meaning to their work.

I make the (in today's educational circles, radical) assumption that my students are in class because they wish to study design. It is for this reason that we must reject the notion currently popular in America that the professor's role is authoritarian, disciplinary in nature, and that the teacher should be a part-time policeman. Therefore, students are free to come and go, and their class attendance is never noted down in an ominous little black book. Grades (a mechanical method for determining the relative proficiency of each student within the group) are never used in that manner. Instead, students whose ability is clearly superior at a given point in time are encouraged to "skip" entire semesters or even school years.

Those who seem to find it difficult to work meaningfully in design are counseled to go into other fields, or other schools. This relaxation of the professor's role as a disciplinarian removes one of the most harmful

and destructive side effects of American education: competition and aggression. It is plain to see why these twin drives are encouraged in our educational processes, for without them the profit system would fail utterly. Each student should be able to demand the "highest standing in class" (a grade of A) for a semester's work *before* the semester begins. This and the other grading procedures outlined above fulfill a double purpose. For one, they expose the bankruptcy of the competitive university system; secondly, they liberate the student from the cares, worries, and pressures over his marks which sometimes end in suicides. *Instead the student becomes a participant in his own growth, is changed by his environment, and in turn, changes it.*

Today's student (child born in the era of television, electronic information, and film) brings many different skills to school before the first lesson has been taught. Unavoidably, he will be possessed of more recent, more accurate, or more relevant information in some fields than his professors. Therefore, a class of 10 students and one professor is really a group of 11 teachers, 11 researchers in search of knowledge, whose differing backgrounds complement each other. In schools where I have worked we encouraged the students to teach each other. If we were lucky enough to have a student in class who worked in the electronics industry at some time or who drew exceedingly well, he would be asked to take over the relevant teaching. For it has become abundantly clear by now that the main task of the school is to learn from and be changed by the students.

Students in advanced classes must have the right to vote on who teaches. In my school they help us write our ever-changing curriculum and frequently initiate entirely new courses which they feel are needed. In order to experience different working conditions, student not only work on individual projects but are also frequently given an opportunity to work in "buddy-teams" (two students). Often larger teams

are formed encompassing students and professors from different disciplines. The problems to be solved may vary in time from simple 2-hour exercises to problems lasting a month or two. In some cases, a larger team may work on a more formidable problem for a full year. Since each student, in order to learn the meaning of integrated comprehensive design, is encouraged to analyze each problem given thoroughly for social and human content, every student has the right to refuse work on any particular problem and to substitute a different problem of his own. Students also have the right to challenge whether a problem should be undertaken by the entire class. Such topics are settled in free and open discussion; from time to time problems are changed or substituted as a result of these discussions.

The old saying, "A teacher can learn from a student," happens to be literally true. It is for this reason that I encourage students to involve themselves in teaching in some manner. It is only through explaining the absurdities of our social system to others that we learn to see through them ourselves. And it is through teaching and working with groups usually not within the experience of the designer that we begin to understand the true needs of people or sometimes even the existence of certain groups. As Ho Ching-chi wrote in his introduction to his opera *The White-Haired Girl*: "The people are our teachers, and it was they who taught us what work to do. They are our most reliable judges and authoritative critics. They are sometimes the creators of this art. . . ." (Peking, 1954.)

For this reason, too, I urge students to travel widely and to work in many jobs—jobs not necessarily in design. They may work in offices, industry, or factories and farms. Such work forms a required part of their study during summer vacations; a full year of "internship" is helpful whenever practical.

A more ideal learning environment, possible today is described in Chapter Twelve.

As mentioned above, the experience of working as

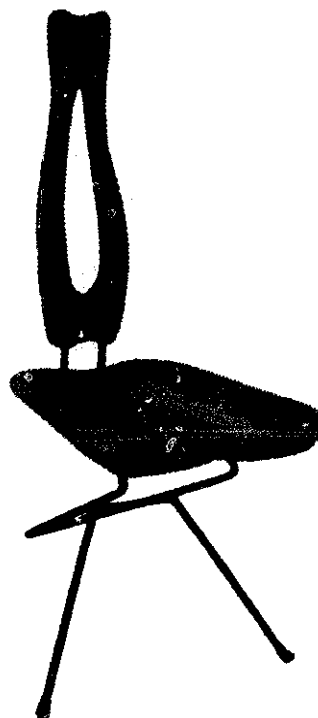
part of multi-disciplinary teams is essential. This may be one of the hardest things of all to teach. Young designers have been sold and over-sold the concept of the lonely, struggling genius, the individual problem-solver. Reality does not bear this out. Most working designers today find themselves part of a team (like it or not). They may attempt desperately to hold on to the reassuring self-delusion that they are working alone, but, in fact, they are not. A typical marketing enterprise today will consist of upper management personnel, market and motivation research experts, advertising people, production engineers and, often as not, consumer psychologists. Some of these people wield decision-making powers; others may work as consultants; still others may have broad advisory powers. In many cases, in fact, the designer finds himself just a sort of vermiform appendix to the marketing-cum-advertising brigade.

Integrated design needs teams of specialists too—specialists from areas whose orientation is not private profit-making, but rather a human and humane concern for man and his environment. Such a team might consist of a designer, an anthropologist, a sociologist, and people in specialized areas of engineering. A biologist (or at least someone versed in bionics and biomechanics) and medical and psychological experts would complete the team. Last, but very importantly, the people for whom the design team works must have representation on the team itself. Without the cooperation of the eventual “clients,” no socially meaningful design can be done. When students are first faced with this concept, they try to escape a confrontation with some client groups by assuming that there will be communication difficulties, or that the members of the group might be too ignorant to realize their own needs fully. Such lack of faith in the people can never be really justified.

I have operated on design teams which included uneducated rural poor people, small children, or mentally disturbed patients. While a communications link

RIGHT: Chair designed for an international competition. Weight is relieved from the spinal column and distributed over the fatty tissues of the back. Designed by author, while still a student. The chair sold successfully, but was eventually withdrawn from the market by the designer on the grounds that it was ugly and expensive.

BELOW: The chair redesigned for easy manufacture through cottage industries in the Southern Appalachians. It is simpler and less expensive, and money goes directly to the people who carve it. Author's design.



was slow and difficult in coming about, we finally succeeded in every case, and as a result were made directly aware of needs which the professional opinion-takers didn't realize or considered unimportant.

The above is by no means a "blueprint" for an ideal team, as many other disciplines may need to be represented in specific cases. Aside from the socially progressive orientation of such a team (compared with the marketing team mentioned earlier), our new team no longer consists of managerial decision-makers and consultants, all of whom think of the designer as a sort of glorified "errand boy." Rather, it is a free and equal team of professional experts whose only aim lies in designing-planning. It is the task of the design team not only to *solve* problems, but also to search for, isolate, and identify problems that need solutions.

It is in this last area: locating, isolating, and identifying problems, that the schools fall lamentably short and in fact often provide no practice for the student at all. Students in most learning situations are asked to solve projects. This means that a "special-case" situation is presented to the student and, after a certain amount of time, the student is expected to regurgitate a "special-case" answer to the teacher. Thus, he may be asked to make a ceramic teapot for 6 cups of tea, and this (embellished in his own particular way) is precisely what he will return to the teacher. Instead of the concept of a ceramic teapot, we could as easily have substituted the design of a better chair, a city plan for the Chicago ghetto, or a magazine cover. It really does not matter what specific problem gets plugged in, for in each instance it is a "special-case" situation, and that is *not* the way things work. Even if *all* the problems assigned were to be socially relevant, the "general-case" learning experience of the student would still be nil. The human mind, as well as human problems, continuously moves from generalizations to particulars and then broadens out to generalizations again. It is a never-ending pendulum swing between "special case" and "general case."

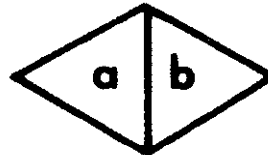
A problem can be assigned as either a special or a general case. What is important is the functional processing of the idea by the student, the designer, the team, or the class, as well as their understanding of this process and its links to other similar processes. A few examples will suffice: a problem may be assigned as "special case"; for instance: "Design a chair!" The student will then move from this special case out towards the generalization "chair." He will review alternative design strategies and, from these, develop a number of so-called "sets." These "sets" are various directions, general and often mutually exclusive, in which the problem can be solved. Just a few of these "sets," which the student may discover in a general

Candlesticks specifically designed to be made through home-cottage industries in Southern Appalachia where these candles are also made. Author's design.



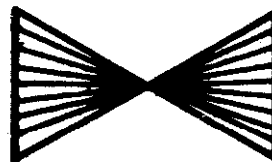
case, could include: a disposable chair, a chair for people with injured backs, a chair for children in primary schools, a method of sitting in a boat, a chair for performing some specific technical task such as playing in a string quartet, a "fun" chair that will appeal to a particular sub-group, etc., etc., etc. The student now selects his particular "set" out of the general case and proceeds to work towards his own special-case solution. This is shown schematically in Diagram A.

Diagram A:
One design "Event"
Special case to general case to
special case.



A "general-case" problem statement might be: "Design something to help underdeveloped countries!" The student now has to engage in a great deal of research from various sources and disciplines. From these he may eventually narrow down to the special-case concept "bicycle-like power source." But in developing this design concept he will unavoidably find many spin-offs and spill-overs and thus again arrive at many general-case solutions and applications. (It is specifically this type of problem that is almost never set in school.) This process (looking somewhat like a butterfly or a bow tie) is illustrated in Diagram B.

Diagram B:
One design "Event"
General case to special case to
general case.
(Or Team problem)



It should be obvious that in any team design problem the flow diagram will be as in Diagram B. Many different students are assembling general-case information through research and bringing this together as an information package to be commonly shared under "special case." From here they will again fan out to many general-case solutions.

It will be useful to remember that both Diagram A and Diagram B can be thought of as single links in continuous, cyclic chains, as in Diagram C. As shown in Diagram D, both "events" (Diagrams A or B) interlock.

A series of possible design "events" (Diagrams A and B) will yield an omni-directional, 2-directional net of equilateral triangles organized into close-packed hexagons, with no wasted space. This is shown in Diagram E.

Diagram C:
A series of design
"Events", cyclic
in nature.

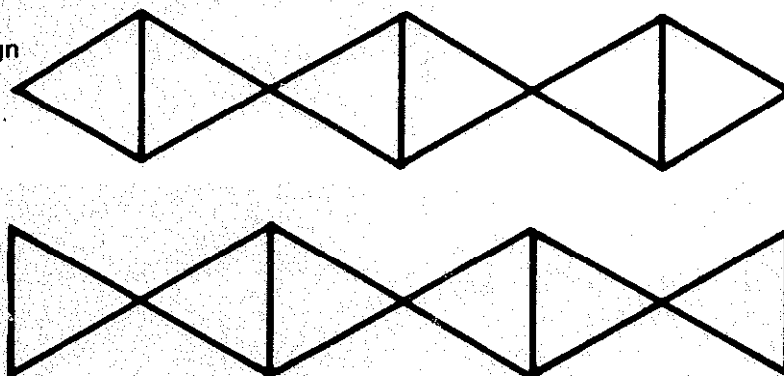


Diagram D:
The interlocking of design
"Events" (one cycle).

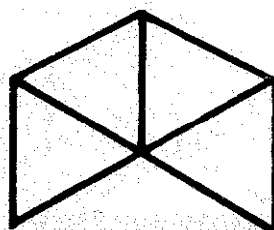


Diagram E:
The omni-directional net of
several design "Events."

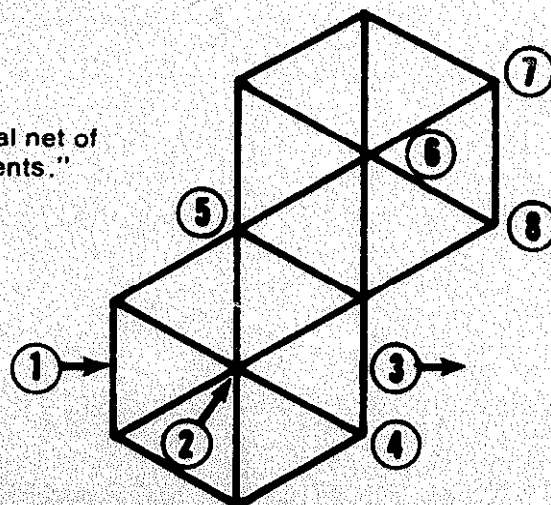
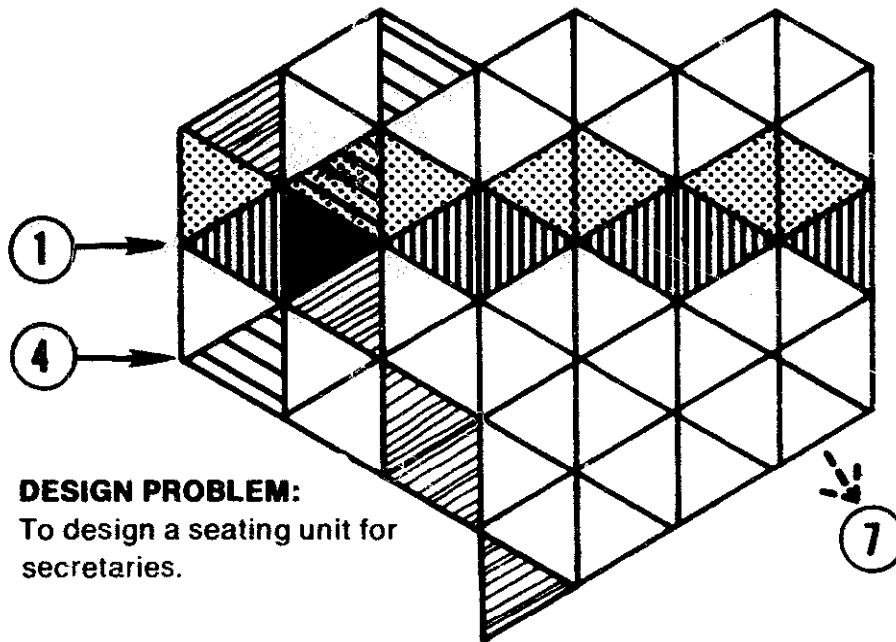


Diagram F:

Schematic representation of the behavior of a multi-disciplinary team. Only a small section of the hexagonal net is shown.



DESIGN PROBLEM:

To design a seating unit for secretaries.



Designer's cyclic path (triangles a, b, c, d, e, etc.) if uninterrupted by other disciplines.



Doctor's cyclic path (triangles u, v, w, x, y, z): the treatment of work-induced diseases.



Sociologist's cyclic path (triangles p, q, r, s): work habits and attitudes of secretaries in offices.



"Client" group's cyclic path (triangles g, h, i, j, k): in *this* case, office secretaries, doing their work.



Intersection of various disciplines' paths.



Cyclic paths of other groups not concerned in this particular problem.

- 1: Entry point of designer.
- 4: Interface between sociologist's path (near point of his emergence) and consultation with some other discipline, say, engineering.
- 7: One of many possible, unpredictable emergence points by the team.

By studying the schematic function of Diagram E, its use can be seen easily. The designer or student may start with a general-case idea input at No. 1, confidently expect to reach special case at No. 2, and hopefully plan to derive an answer at No. 3. However, No. 2 is a locus for at least 6 different disciplines, and he may in fact eventually emerge at either general- or special-case points No. 4, 5, 6, 7, 8, . . . or "n." Diagram E then becomes a schematic representation of a series of interlinking "events," each one of which can be represented by a flow chart, each flow chart carrying with itself the bias or "set" of its own particular discipline.

(Note: We must remember that our schematic representation of the design process of multi-disciplinary teams as shown in Diagram E has been reduced to a 2-dimensional sketch. A truer representation of this flow of information and processes would be a 3-dimensional model consisting of a number of tetra-kaidecahedra, close-packed in space. Loci or information-exchange areas would then be represented by the hexagonal faces; directions of design processing by the axes of the square faces.)

Now let us examine the flow of a real design problem through our schematic. An illustration of this will be found as Diagram F: At No. 1 (triangle "a") the designer enters the picture with a special case problem: "Design a chair." Triangle "a" represents his normal data-gathering phase, bringing him to point No. 2, the general-case collection of his ideas. At this point he is still independently acting as a designer; if left to his own resources he would eventually emerge at No. 3 (triangle "b") with, say, a low-cost desk chair for secretaries. Still left to his own resources, he might now, still at No. 3, begin his next design job (another chair, a tool, or whatever). This would carry him through triangles "c" and "d." (In fact the undisturbed activity of a typical designer-specialist of today can be read as the cyclic axis: a, b, c, d, e, etc.) However, our designer friend is not a specialist, but rather a

member of a multi-disciplinary team. When he reaches No. 2, he has not only reached general case data, but also the intersection of several other lines of thought. For here the medical doctor, for instance, will bring forward information regarding sitting postures (normally the doctor's own cyclic axis would continue towards triangle "w" as well as x, y, z—the treatment of work-induced diseases). Here at No. 2 the sociologist (axis: p, q, r, s) and some secretaries as representatives of the client group (axis: g, h, i, j) also intersect. Our designer, through meeting and working with many other team members, may finally emerge at, say, No. 7 (triangle "m"), which might be a systems design for a communications device that permits secretaries to work in their homes.

As has been explained earlier, in order to understand all the ramifications of integrated comprehensive design fully, it is necessary to try to become aware of all the parameters that have bearing on the design process. Since there are so many factors and variables involved (more than can possibly be kept in mind), I find that the simplest solution is to *externalize* it by constructing a flow chart. A flow chart (as my students and I use it) is generally a large roll of brown wrapping paper pinned across an entire wall. Written down on it are all the various aspects that have bearing on analyzing the design.

Recently, during the primary design stages of a playground for a slum area, such a chart was constructed. Some of the factors that appeared on the chart were: Psychological and physiological needs for participation, exercise, and group-needs of children at various age levels. What kind of supervisory personnel would be needed, and how available they were in the area. What kinds of playground equipment could be designed and built and with what resources, what tools and processes. How money could be raised for this.

What materials could be used for constructing equipment and toys, and what were the characteristics of these materials under: (a) extremely hard wear

and use; (b) frost, ice, snow, storms, and hard rain; (c) prolonged use over a period of 5-15 years; (d) dangers of shearing, splintering, torque, or fracture while being used by a child; (e) toxic characteristics of the various materials and coloring agents; (f) perceptual and psychological responses of children (at various age levels) to the colors used; (g) relative ease of care, maintenance, repair, and replacement of equipment, etc. We also included questions regarding the setting of the playground within the neighborhood area with such determinants as: (a) location of playground entrances in relation to main traffic arteries; (b) number of streets to be crossed by children hoping to use the playground; (c) illumination of the playground at night; (d) accessibility to homes and other neighborhood centers such as nursery schools, kindergartens, day-care centers, etc.

We also listed possible ancillary services such as: toilets, drinking fountains, a swimming pool, a wading pool for small children, telephone facilities, first aid equipment, a rain shelter, benches for older people, landscaping (grass-planting, bushes, trees, and flowers), etc. We also listed activities other than play which might take place within this area, such as outdoor concerts, motion picture showings, or street theater for older people; "story-time" and "sing-alongs" for smaller children; dances and athletics for teenagers, etc. Climatic considerations also had to be applied: could parts of the playground be flooded for ice skating during the winter? Could some of the hills (which we were to create with bulldozers) be used for bobsleds, sleds, and skis? What about drainage problems during rainstorms and after the melting of the permafrost in the spring? These are just a few of the areas which we considered on our flow chart.

A flow chart works in a quite simple way: We listed all the parameters we could think of (some of which are mentioned above), putting each under whatever classification seemed to make most sense. Under activities, for instance, we might list: climbing, jump-

ing, running, sliding, singing, talking, and many, many more. After everything had been listed, we then began to establish *relationships* where none seemed to exist before. For example: under "materials" we listed sail cloth or heavy canvas. Its characteristics are (when stretched and supported like a membrane) buoyancy and comparatively resilient softness. This could now be brought into a direct relationship with "jumping" and suggest a trampoline-like structure to us. One of the most important functions of a flow chart is that new relationships or inter-linkages can be read directly off the wall and that solutions, or at least direction for solutions, emerge without their ever having been consciously listed. Another point about a flow chart, of course, is the fact that it can, by definition, *never be complete*. That is, new concepts and entire new categories can be added almost indefinitely, and hence new relationships and inter-linkages will constantly emerge.

At this point, half of the flow chart (or triangle "a" in Diagram A, above) has been completed. The second half of the flow chart (triangle "b") will consist of implementation. That is, who does what, when, how, and by what date. Here again, alterations and additions can be continuously performed. The entire design team keeps the flow chart on the wall until *after* the design job is completed.

We can now establish the work flow of any design job:

- 1 Assembling a design team representing all relevant disciplines, as well as members of the "client group."
- 2 Establishment of a primary flow chart (triangle "a" part only).
- 3 Research and fact-finding phase.
- 4 Completion of the first half of the flow chart (triangle "a").
- 5 Establishment of the second half of the flow chart (triangle "b"): "what to do."

- 6 Individual or "buddy-team" or team design and development of ideas.
- 7 Checking of these designs against the goals established in the flow chart, and correcting both the designs and the flow chart in the light of these design experiences.
- 8 Building of models, prototypes, test models, and working models.
- 9 Testing of these by the relevant user-group.
- 10 Results of these tests are now fed back into the flow chart.
- 11 Redesign, retesting, and completion of the design job, together with whatever written reports, graphic communication, statistical support data, or working drawings are necessary.
- 12 The flow chart is then preserved, to be used as a follow-up guide in checking actual in-use performance characteristics of the design objects. After this the flow chart is filed, to be used as a guide for future design jobs that are similar in nature.

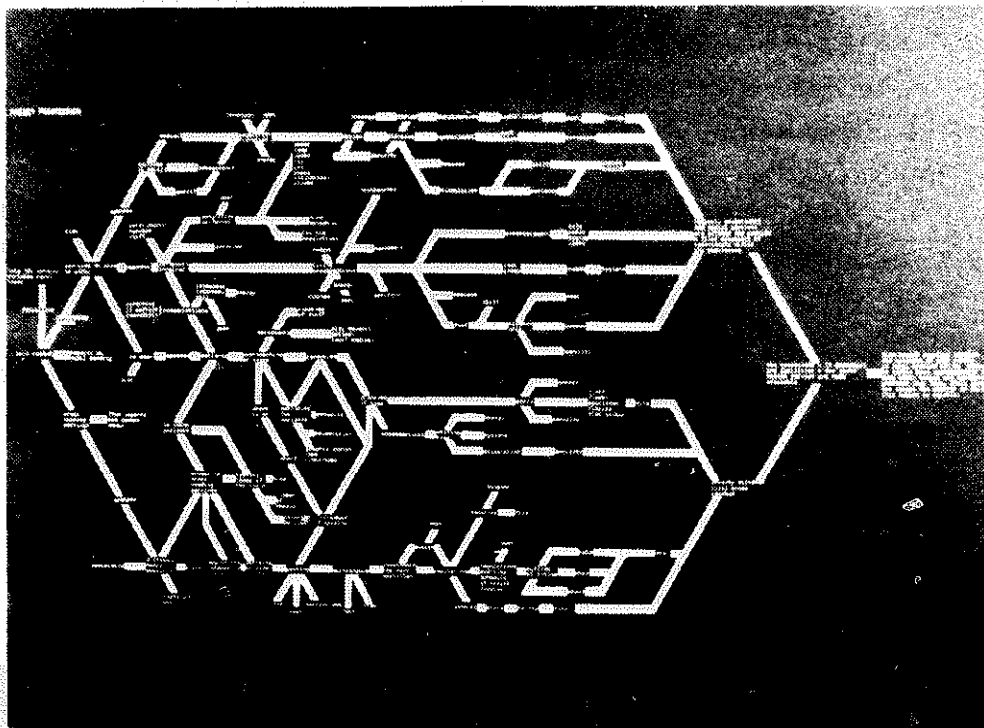
It should be obvious that in reality the design process can never follow a path quite as linear and sequential as suggested by this example. (For one thing, new research data emerges continuously.) Nonetheless, this should give some idea of a flow chart and its use in design.

While participating in a design conference held by the Scandinavian Student Design Organization (sdo) at Copenhagen in the summer of 1969, it was my job to construct a "general case" portion of a flow chart, concerned with the social and moral responsibility of the designer and his position in a profit-oriented society. This is a large job indeed. In fact, this entire book attempts to address itself to precisely that question. Nonetheless, the flow chart is reproduced in this book, and a few explanations are in order. As the meeting dealt with the question of handicapped

people, columns A and B attempt to point out that *all* people are handicapped in some way or another for at least part of their lives. One small entry in column A has been isolated: the concept "blindness." Here an attempt has been made to show that even people wearing only mildly corrective glasses are somewhat handicapped in the area of seeing. Seven out of more than 200 optical disturbances have been listed.

Column C lists the *real* needs of the people (partially and imperfectly at best). Column D, "What the people want," is empty for reasons that will appear later. Column E lists what the people are *told* they need and want—in other words, the substitutions made by our society for real needs. Column F shows the processes used in achieving these false goals, and column G attempts to show just a few of the repressive measures used by our society to prevent the attainment of *real* goals. Column H, labeled "How to change this," lists the revolutionary and evolutionary activities of education, creativity, social planning, and research. Through links it attempts to show that it is these processes that are "design." Under column I a number of thoughts (even catch-phrases and slogans) have been put down, in the hope that more will be added. Interestingly enough, it is the connection between social planning, revolution, creativity, education, evolution, and research under column H and these random thoughts under column I that provide us with our first major insight into column D ("What the people want"). Finally, column K attempts to show the make-up of a design team, together with some of the specific disciplines that must be fed into it. At the extreme right of the chart, a large arrow points to 6 activities. It is these 6 activities that will eventually make up the right half (triangle "b") of the flow chart, things to do, the "operative" phase. *All socially relevant, integrated comprehensive design must be operative—that is, related to the true needs of the people.*

The accompanying flow chart is far from complete,



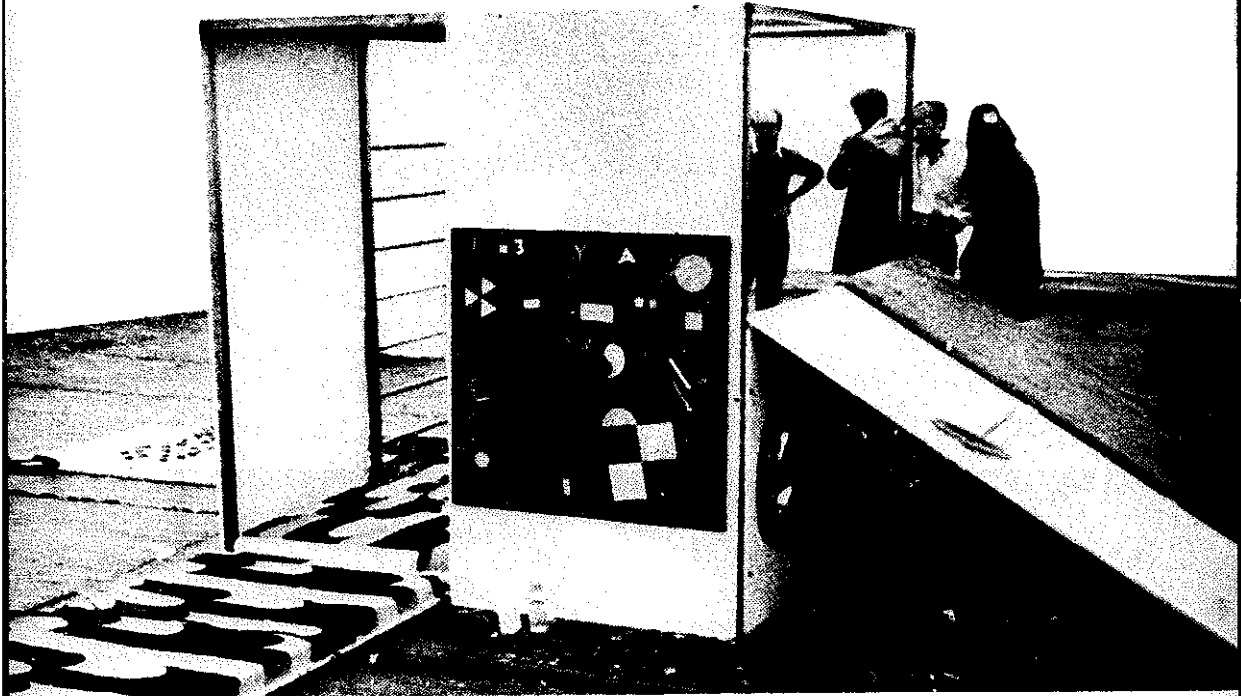
Right-handed half of the flow-chart (part "b").

This is a study for using old railroad cars to bring health-care services to poor rural areas. Graduate student-team designed by Jules Belanger, Pierre Bossé, David Koropkin, and Louis Noriega, California Institute of the Arts.

both in the number of entries or even in the number of relationships or linkages established between what entries have been provided. The reader is encouraged to play with the flow chart, to add to it and discover his own relationships. The right half has been purposely left open: completed, it will form a social and political blueprint for tomorrow—for society as well as for design—far beyond the scope of this book.

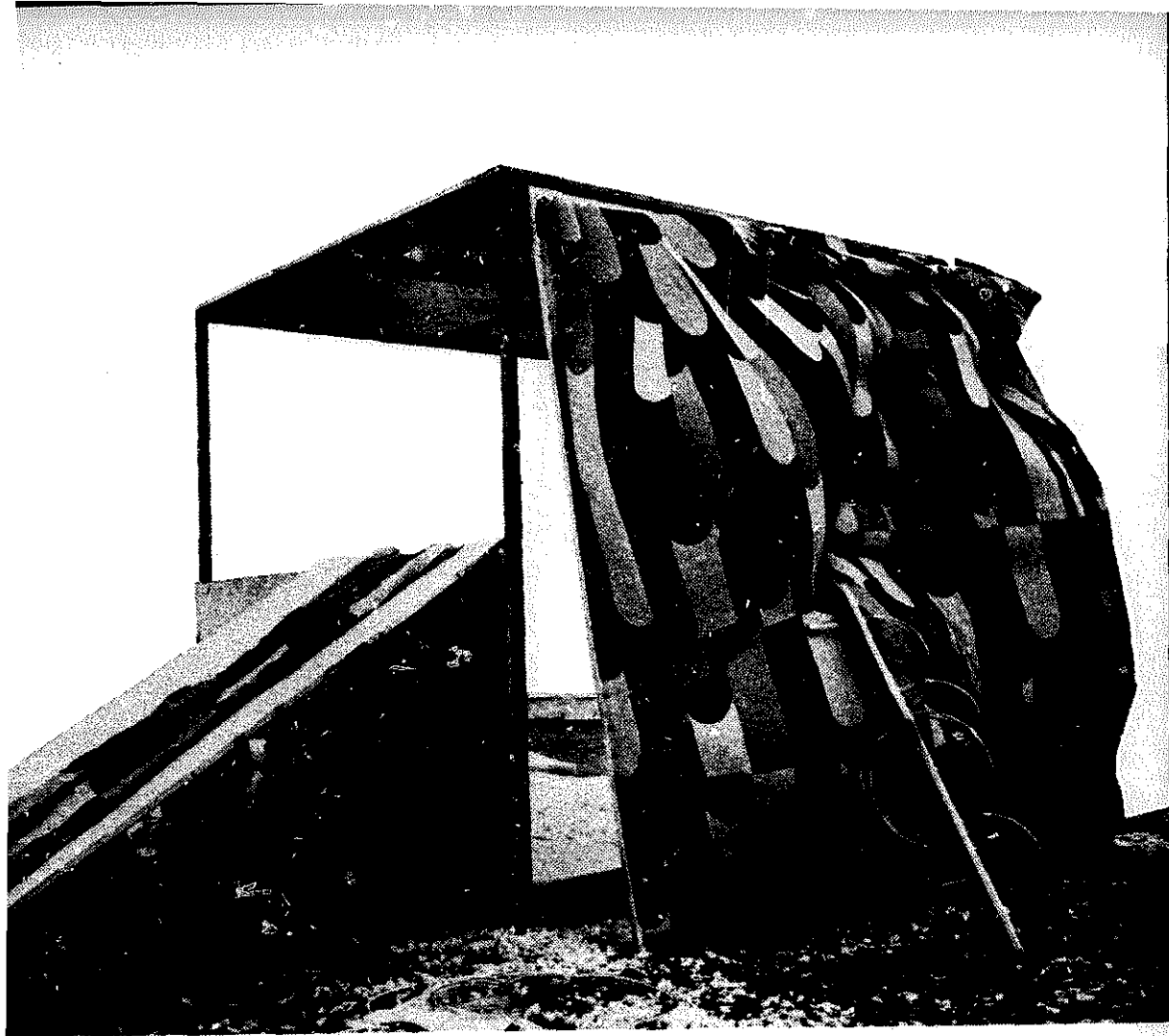
It can be argued that the subject of this particular flow chart is too broad. But flow charts are, by their very nature, "general case" statements. A very narrow subject would have become too highly technical for general understanding.

An exercising and play environment built on Suomenlinna in Finland. Designed and built by a cross-disciplinary team of students under the direction of Zoltan Popovic, Yrjö Sotamaa, and Victor Papanek.



All this, however, is merely a broad philosophical background. What about specifics? What sort of things can be used in training students to design?

During the summer of 1968 a multi-disciplinary team of design students (under the guidance of Yrjö Sotamaa, Zoltan Popovic, Barbro Kulvik-Siltavuori, and Jorma Vennola) worked with me on a small island in Finland and invented, designed, and built a foldable, moveable environment for children with cerebral palsy. This environment included toys, exercising devices, and many other pieces of equipment. We met in Helsinki, after the 8 student members of the team had already played with and interviewed the children. They had also spoken to parents, visited clinics, playgrounds, and homes. They had found that little or no equipment had been specifically invented or provided for children with cerebral palsy and that some of the



toys now in use to train such children in specific motor skills were inhumane and barbaric. (CP children must be trained to use their thumb and index finger in grasping. It is their natural tendency to use the other three fingers instead. Until now they have been trained by strapping or tying these three fingers together, thus being forced to use thumb and index finger alone. Several toys were designed and made that provided reward-sequences and enjoyment to the child only when he used the first finger and thumb. In this way the medieval practice of forced restraints could be abandoned.) The students also found that clinics and hospitals were drab and unexciting.

We made a flow chart and met as a team, together with two experts in child psychology and neurophysiology from Sweden. As a team we spent a total of 12 hours developing a 2-meter cube which knocked

down into two sections each $2 \times 2 \times 1$ meters in size. This module permits the 2 parts of the cube to be moved easily from clinic to clinic, to be carried through doors and transported on small trucks. Once erected at the clinic (indoors or outdoors), the cube unfolds into a play environment that is 2 meters high, with equipment covering an area of 16 square meters. It is bright and colorful and includes slides, climbing, a crawling surface, and many individual toys. It is also easy to build and low in cost. Our first prototype cube was built and completed (including toys) in 30 hours of teamwork and then tested with children. We called it "CP-1" to suggest that it was merely the first of a generation of similar cubes, each one of which would be modified by testing and experiences with children. We also assumed that other cubes (for instance, for hydrotherapy, autistic and retarded children, etc.) will eventually be built. A fuller discussion of this, together with photographs, will be found in *Industrial Design*, November, 1968.

During January, 1969, students at the State School of Design at Oslo, Norway, worked with me for 2 weeks to develop a playground-environment for the backyard of a group of old, inner-city apartment houses. The 6 buildings comprised in the area housed nearly 70 children who could play only in the dangerous streets as the 3 backyards were given over to garbage pails, high metal fences, and laundry lines. The students began interviewing the residents of the various buildings.

Through their interviews many new facts emerged for our flow chart: Elderly people declared themselves uninterested in meeting new people or talking with them, but took great pains to invite our students into their homes for periods up to 2 hours and served them tea and cookies while telling them so! With some justice, we felt that some of these older people were unaware of their own motivations and needs, and could be drawn into the social group. Some might even be willing to help supervise play. Younger people were strongly in favor of constructing the playground, and

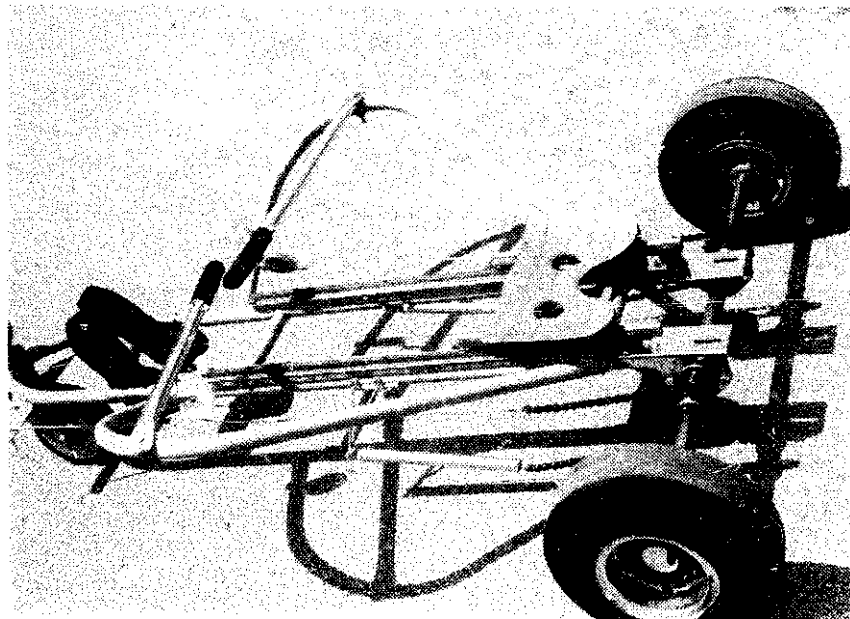
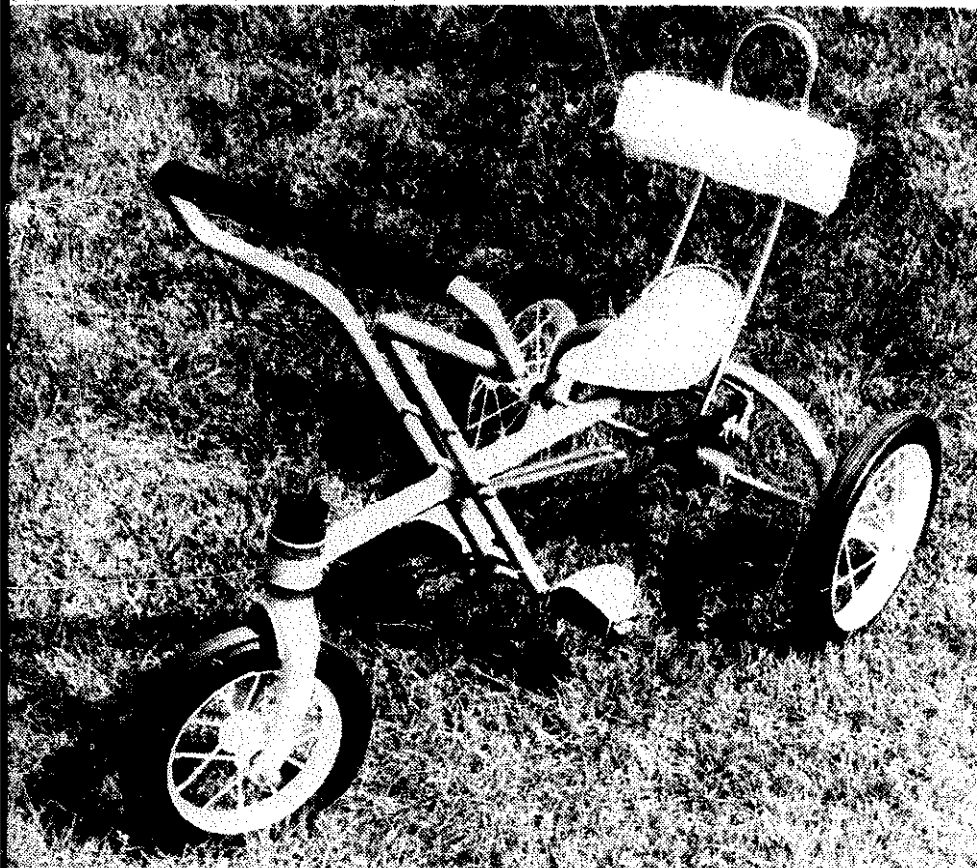
many offered to help with money; a few ashamedly confessed that they were too poor to help financially. We felt that it was precisely the poorer people who, by being taught to help through their work instead of monetary contributions, could be drawn more strongly into a social group engagement.

The parents promised to support the work, as the nearest park or playground was several miles away. The youngest person interviewed was a four-year-old boy who immediately began peering out the window to see if the playground was there yet. We can imagine that he kept pestering his mother and the neighbors day after day, relentlessly, as small children do, and that, in fact, he was probably our strongest propaganda weapon. After our flow chart had reflected such diverse data as interview results, mean annual sunshine distribution, newer methods of storing the garbage, etc., we were ready to go to work.

The students were appalled to find that the backyard was infested by rats and that the children played with the rats and thought of them as pet animals, something along the order of small dogs. We saw that design would have to go beyond a playground to include factors of public health and hygiene. Because of the social relevance of this project, other students from the Architectural School, the School of Landscape, and Oslo University became interested and volunteered their help, even though students from these schools normally have little or no contact with the State School of Design.

I must admit that at first many of the students became interested because of the novelty of the problem. Later they found that being involved in this type of social design is much more difficult than creating still another teapot or a perfect salt cellar. Many were discouraged, and some dropped out. Yet the landscaping, the design and development of equipment, drawings, and a 3-dimensional model of the eventual playground were completed in time.

The next step would be to invite the people now



UPPER LEFT: A least-effort vehicle designed for children with cerebral palsy. Both the pedals and the arm move the vehicle. Whatever limb the child can use propels him, while the other limbs are exercised. Designed by Charles Lanius, as a student at Purdue University.



LOWER LEFT: An exercising vehicle for disabled or retarded children. Designed by Robert Worrell, as a student at Purdue University.

UPPER RIGHT: Vehicle for exercising children with weak arms and shoulders. Designed by Charles Schreiner as a student at Purdue University.

living in these tenements (including the childless and the elderly) to see the work that the students had done. It would then become possible to mobilize the people living there to work with the students in building the play environment. Benches and "quiet corners" had been provided for older people; an inner courtyard apartment was to be turned into a laundry area with one or two washing machines so that the mothers could wash their clothes, drink coffee, gossip, and watch the children. But even if this playground were to be completed, this would not end the work.

By accepting the responsibility of involving themselves with the people living there, the students had also accepted a more permanent responsibility towards these same people. It was up to the students that outdoor movie showings, guerilla theater, poetry readings, and "sing-ins" be brought to the backyard on long summer evenings. Through engaging in these activities, the students came to a closer and "operative" understanding of the people's problems; the people, in turn, assumed a more active role in shaping their own future and gained pride and identity. A secondary result should spring from the playground: its evident success should stir other communities and tenement blocks into similar actions.

At Purdue University we concerned ourselves with the problems of paraplegic, quadriplegic, spastic, and palsied children. We designed and built a series of vehicles with built-in motivational factors that will provide healthy exercise and training for these children. A study showed that the nature and extent of their handicaps and abilities varies greatly. Some can use only their arms, some only their legs; with others the entire right or left side is useless; a few have the use of only one limb. However, in many of these cases it is healthy to exercise the useless limbs. One thing which all these children have in common is a great enjoyment of speed. The vehicles illustrated were designed so that they can be operated with one or more limbs; the others are exercised in the process. The

harder the child exercises, the faster he goes. Hence, enjoyment and exercise go hand-in-hand. The vehicles were tested with handicapped children and were turned over to local clinics.

Let me give another example of design used effectively for disadvantaged people.

The American South and the Midwest are criss-crossed by railroad tracks, with the depot usually in the downtown area of the town or village. So as one of our projects my students and I designed 3 trains, each to serve a specific function, to be staffed by trained personnel, and to be parked in a small town for 3 or 4 months at a time. One of the 3-car trains will operate as a vocational re-education center; the others will provide birth control information, ophthalmology clinics to issue eyeglasses, clinics to perform dental services, issue corrective devices for birth defects, and operate in disaster areas and as epidemic control centers.

Our work for Mexican migrant farm laborers and for the white, alienated rural poor of eastern Tennessee and western North Carolina was desperately needed by them.

Because Navaho, Hopi, Zuñi, Mescalero Apaches, and other Indians feel that, for moral and religious reasons, they must have a large share in the construction of their homes and because, furthermore, they move twice a year, from their winter camp to their summer grazing land and back, and because they feel it is wrong to kill vermin, we worked on a shelter design for their very special needs. One of our graduate students developed a minimal shelter (related more closely to the Navaho's concept of space than to an "adapted" white man's house) that keys in exactly with the Indian style of life. The shelter is woven in parts (weaving is a major Navaho skill), and the wool is vermin-proofed during the weaving process. These woven parts are stuffed with dried native grasses that insulate against extremes of heat and cold. A number of these parts can be zipped together (thus the shelter is self-erecting) to form an enclosure of nearly any

desired size. Zipped apart, it can be easily moved on horseback during the two annual treks. All in all, it is far better suited to the territorial, cultural, and religious aspirations of the Indians than the confections doodled up by the Department of Health, Education, and Welfare.

In ending this brief list of a few gadgets and designs, we should also concern ourselves with what the student has gained. Obviously he has engaged in research, worked with a team, met the needs of people, operated with a flow chart, and gained new skills and new insights. But the actual learning content of these problems is far greater than that, going from the immediate to the more permanent. A series of educational steps and learning experiences have taken place, all of them on an interactive level. It might be best to list them now:

- 1 The student has located, identified, and isolated a problem. In so doing he has interacted with other members of a multi-disciplinary team and engaged in a meaningful work experience with a group of clients whose existence and needs were previously unknown to him.

- 2 Through his work he has made the client people aware of the promise that design (applied intelligently) can hold out for them. He has satisfied their needs at least partially.

- 3 By working with and helping the group, he has exposed

- a the needs of the group to society.

- b the lack of knowledge on the part of society regarding the needs of the group, or the very existence of the group.

- c the cynical indifference of the governmental power structure and industry to most of the genuine needs of people.

- d the inability of traditional design-as-it-is-taught to cope with genuine social problems.

e the existence of methods and disciplines to work intelligently for these needs.

f the obvious lack of schooling and training in this, the most important area of design.

4 He has engaged in satisfying work; never again will it be possible for him to engage in the kind of design directed towards "good taste." Having experienced this kind of work, he will forever after feel a little ashamed when he designs a pretty, sexy toaster.

He will forever after feel a little ashamed when he designs a pretty, sexy toaster. . . .

12 DESIGN FOR SURVIVAL AND SURVIVAL THROUGH DESIGN:

What Can We Do?

Some men see things as they are and say, why?
I dream things that never were and say, why not?

—ROBERT F. KENNEDY

Again: Design is basic to all human activities. The planning and patterning of any act towards a desired, foreseeable end constitutes a design process. Any attempt to separate design, to make it a thing-by-itself, works counter to the inherent value of design as the primary, underlying matrix of life.

Integrated design is comprehensive: it attempts to take into consideration all the factors and modulations necessary to a decision-making process. Integrated, comprehensive design is anticipatory. It attempts to see trends-as-a-whole and continuously to extrapolate from established data and intrapolate from the scenarios of the future which it constructs. Integrated, comprehensive, anticipatory design is the act of planning and shaping carried on across all the various disciplines, an act continuously carried on at interfaces. In metallurgy it is at the boundary layers (the interfaces between crystals in metals) that action takes place under force. These very imperfections make it possible for us to shape and deform metals mechanically. Geologists tell us that the great changes on earth take place where forces meet along boundary lines. Here surf meets shore, fault blocks move in different

directions. Diamond cutters cut along flaw lines, the sculptor's chisel follows the grain, and naturalists study the edge of the forest meeting the meadow. The architect's main concern is with the juncture between building and ground; the industrial designer is concerned with the smooth translation between working edge and tool handle, as well as with the second interface, the "fit" of tool and hand. Passengers relax visibly after that split second when the airplane finally leaves the ground, and for every navigational map of the ocean, there must be a thousand showing reefs and shorelines. We fight our wars over symbolic boundaries which we draw across our maps, and find life's most shatteringly poignant experiences are crossing the boundary lines of birth and death; our apotheosis is the sex act: ultimate encounter between interfaces.

It is at the border between different techniques or disciplines that most new discoveries are made, most action is inaugurated. It is when two differing areas of knowledge are forcefully brought in contact with one another that, as we have seen in a previous chapter on bionics, a new science may come into being. Frederick J. Teggart, the historian, says that "the great advances of mankind have been due, not to the mere aggregation, assemblage or acquisition of disparate ideas, but to the emergence of a certain type of mental activity which is set up by the opposition of different idea systems."

Acceleration, change, and the acceleration of change itself arise from the meeting of structures or systems along their edges. Intuitively, young people today have sensed this; their repeated use of "confrontations" is a symbolic, externalized illustration of this fact.

By its very nature the design team thrives on such confrontations, being itself born of interfaces. The design team is structured to bring many different disciplines to bear upon the problems that need solving, as well as to search for problems that need to be rethought. Its task is to do research to find our true needs

and to reshape environments, tools, and the way in which we think about them.

Currently, it is fashionable to be concerned over the advent of the computer age. And although the foreseeably increased use of computers divides people into two sharply opposed camps, it is often conveniently overlooked that the viewpoints of both factions are essentially negative. The first group sees computers as a threat to organized labor, to the standard 40-hour work week, and to the Puritan work ethic, and finds much to ponder and fear in that. The other group, while realizing that the computer may finally help to phase out drudgery and back-breaking work, as well as that work's equivalence in monotonous, routine intellectual labor, also takes a negative view of the future. Here the threat seems to be mass leisure. The anecdote in Chapter Three about Piet Mondrian, painting as though he were a computer, illustrates the particular fear that artists evince when faced by data-processing machines.

But, as the old cliché has it, "Nature abhors a vacuum." As computers begin to take over (or as we relinquish to them) a greater share of those activities that we have heretofore thought of as exclusively intellectual—but which in fact are sheer monotony—new areas of engagement cannot fail to emerge. It is precisely here, at the juncture between computerized "work" and human "leisure," that the design team is located.

In a world in which agricultural and industrial work increasingly will be done through automated factories and in which most routine supervision, control, and computation is performed by computers, the work of the design team (research, social planning, creative innovation) *is the only meaningful and at the same time crucial activity left to man*. Inescapably, it will become the job of designers to help set goals for all of society.

Social historians tell us that the predicament of twentieth-century man can be traced unerringly to the

discoveries of 5 men: Copernicus, Malthus, Darwin, Marx, and Freud. But during just the last 5 to 10 years the interfaces between sociology and biology, between psychology and anthropology, between archaeology and medicine have generated wide new insights into the human condition. Ten new books—Robert Ardrey's *The Territorial Imperative*, Nigel Calder's *The Environment Game*, Edward T. Hall's *The Hidden Dimension*, Arthur Koestler's *The Ghost in the Machine*, George B. Leonard's *Education and Ecstasy*, Konrad Lorenz's *On Aggression*, Desmond Morris's *The Naked Ape*, Hans Palmstierna's *Plundring, Svält, Förgiftning*, Gordon Rattray Taylor's *The Biological Time Bomb*, Fredric Wertham's *A Sign for Cain*, and R. Buckminster Fuller's *Operating Manual for Spaceship Earth*—all appearing within the last few years, have redefined man's relation to man and to his environment in new and startling ways. The interdependence of various disciplines can best be illustrated by a story Bucky Fuller likes to tell:

In the last decade, two important papers were presented to learned societies, one on anthropology and the other on biology. And both these researchers were working completely independently. But it happened by chance that I saw both papers. The biological one was looking into all the biological species that have become extinct. The anthropological one was looking into all the human tribes that had become extinct. Both researchers were trying to find a commonality of causes for extinction. Both of them found the same cause independently—extinction is a consequence of over-specialization. As you get more and more over-specialized, you inbreed specialization. It's organic. As you do, you outbreed general adaptability.

So here we have the warning that specialization is a way to extinction, and our whole society is thus organized . . .

Man is a generalist. It is his extensions (tools and environments) which are designed, that help him to

achieve specialization. But by misdesigning these tools or environments, we often achieve a closed feedback loop, and the tools and environments in turn affect men and groups in a way that turns them into permanent specialists themselves. The potential of any device, tool, or environment can be studied before it is structured or manufactured. In fact, computers now give us the ability to build mathematical models of processes, interactions, and systems and to study them beforehand. The recent strides made in the social sciences are providing greater insights into that which is societally valuable.

For thousands of years philosophers, artists, and designers have argued about the "need for beauty," or aesthetic values, in the things we use and live with. One only has to look out the window, or for that matter, back into one's own room, to see where this preoccupation with the look-of-things has led us: *The world is ugly, but it doesn't work well either!* In a world brought nearly to its knees by abject want, a preoccupation with "making things pretty" is a crime against humanity. But (as we have seen in our function complex in Chapter One) man needs structures and devices that are enriched beyond the severely utilitarian.

Delight, balance, and that pleasing harmony of proportions that we project outward into the world and are told to regard as the Eidetic Image, are psychological necessities for us. And not only a creature as sophisticated as man, but lower species as well, seem to need this aesthetic and associational enrichment. Here is a description of this mechanism among birds, as quoted by a leading philosopher-naturalist:

Everyone knows that most birds build houses, and very efficiently, too. Although not usually artistic, their nests are careful and often ingenious. The tailorbird puts nesting material inside a large leaf, then sews up the edges in a curve so that the leaf cannot unroll. The South American ovenbird, which

weighs less than three ounces, makes a nest weighing between seven and nine *pounds*, out of a hollow ball of earth fixed to a branch. In Australia the rock warbler makes a long hanging nest and attaches it to the roof of a cave by spiders' webs; the reaction of the spiders is not described. On the Malay Peninsula the megapodes build artificial incubators: piles of vegetation mixed with sand, which gradually decay and keep the eggs warm. The birds themselves are not as big as ordinary fowl, but the nests can be eight feet high and twenty-four feet across, composed of five tons of material scratched together from a radius of several hundred yards. The house martin builds a neat little house of clay with a front door. A simple nest, like that of the redstart, means six hundred separate flights for material.

Some birds, however, go further, and build simply for aesthetic effect. These are the bowerbirds of Australia and New Guinea. They are perching birds, between eight and fifteen inches long, which look rather like our own woodpeckers, but are more handsomely costumed. Their specialty is unique. The males make clearings in the forest, and at their edges build elaborate arbors of grass and leaves. On the clearings and in the arbors they set out decorations, carefully chosen and grouped: the heads of blue flowers, shells or brilliant objects such as pieces of glass, cartridge cases, and even glass eyes (though these are harder to come by). The scientist who has studied them most closely, A. J. Marshall, shows pretty clearly that this is simply a variation of sexual display intended to attract the little female, to mark off each particular male's own territory, and to allow him a proper stage on which to display his plumage and his masterful poses. And yet Marshall is bound to admit that the birds seem to enjoy their arbors; that their building goes beyond mere functionalism; and that they display very marked discrimination, which can only be called aesthetic choice, in decorating their bowers. An American collector in New Guinea was making his way through the jungle without thinking of bowerbirds or even

having seen one of their structures, when he suddenly came on a place where the undergrowth had been neatly cleared away from an area some four feet square, and a hut-shaped bower had been built beside it, about three feet tall and five feet broad, with an opening a foot high. "This curious structure fronted on the cleared area. The impression of a front lawn was heightened by several beds of flowers or fruit. Just under the door there was a neat bed of yellow fruit. Further out on the lawn there was a bed of blue fruit. Off to one side there were ten freshly picked flowers." Later this explorer saw the architect returning to its bower. The first thing it did was to notice a match that had been carelessly thrown into the middle of its clearing. It hopped over, picked up the match and, with a toss of its head, threw it out of the clearing. So the explorer collected some pink and yellow flowers and one red orchid, and put these in the clearing. Soon the bird came back and flew straight to the new flowers. It took all the yellow ones and threw them away. Then, after some hesitation, it removed the pink ones. Finally it picked up the orchid, decided not to throw it away with the rest, and spent some time carrying it from one pile to another of its own decorations, until it found one where it would fit in with advantage.

Does that sound incredible? There are other facts about the bowerbirds which far surpass it. After one male has completed his arbor he must guard it, for if he flies off in search of food, a rival male will wreck his bower and steal his decorations. Some species not only decorate their bowers but paint them, with coloured fruit pulp, charcoal powder from burnt logs, and (near homes in Australia) stolen bluing. If a flower in the display fades, it is removed at once; and if a human being interferes, the result of this interference is rectified. One observer took some moss out of a bower and hung it some distance away in the forest. Time and again a radiantly coloured male bird angrily put the moss back. And then the same observer conducted an ex-

periment which I can only call brutal. He set fire to three of the bowers. In each case, a male bird flew out of the trees and perched close by the burning arbor, "his beautiful head bowed and wings dropped, as though sorrowing over a funeral pyre." O Science, what crimes are committed in thy name!*

More controlled experiments have been carried on to prove the importance of aesthetically enriched environments. Recent work done by Professor David Krech at the University of California at Berkeley has provided a multitude of insights. Krech assembled two groups of laboratory rats. One group was brought up in a "deprived" environment, similar to conditions existing for human beings in American slums and ghettos. The rats were crowded, sanitary conditions were absent or nearly absent, food was uninteresting and meager. Their cages were in perpetual gloom, and shrill, unstructured sounds of a decibel level far too high interrupted them during both waking and sleeping. The second group of animals were brought up in an "enriched" environment. Here colors, textures, and materials had been chosen with great care. Food and water were plentiful, vitamin-enriched, and plenty of space was set aside for family grouping. Soft and pleasant music was piped into their habitat, and changing lights and colors further enhanced the environment.

The results of this experiment showed that members of the second "enriched" group had greater learning capacity, a faster mental development, greater flexibility and adaptability to new stimuli, and far better memories. They also maintained their greater mental

* The difficulty with writing a book in many parts of the world is that source material sometimes disappears. The lengthy and charming study of bowerbirds quoted above just had to be included. But the book from which it came is gone irretrievably. Whether it gently floated from Viken towards Denmark or was left behind after a shadow-puppet play in Ubud (Bali) matters little; the fact remains that I would like to acknowledge and request permission to quote it, but knowing neither author nor title, this is somewhat difficult.

capacity into old age. In fact, even their offspring, brought up under normal laboratory conditions, maintained a sizeable lead over the offspring of the "deprived" rats who were also brought up in standard ways. Dissection showed that the size and weight of the cerebral cortex of the enriched rats (the part of the brain responsible for a rich flow of association) was larger, heavier, and more convoluted.

When this experiment was repeated, retaining the differences in environment, *but feeding identical amounts of water and identical food* to both groups of rats, results were almost identical to the first experiment. In both cases the environment-enriched rats developed a high concentration of an important brain enzyme responsible for the growth of brain tissue. The experiment showed conclusively that the environment alone and its relationship to the rats can change the basic brain chemistry.

Although these experiments could not be done on humans, ghettos, slums, most child-care centers, kindergartens, nursery schools, and, in fact, most schools do recapitulate the environment provided for the "deprived" rats. Most parents (considering schools to be only permanent baby-sitting agencies) never ask *whether the teachers are robbing their children of potential brain tissue!*

In fact, the rats' deprived environment can be said to exist (for human beings) over 90 per cent of the world. During the last 25 years or so, man-made environments have begun taking on the characteristics of a natural ecology: they are interlocking, user-responsive, and self-regenerating. All of humanity is fed into this new ecology, with little forethought as to how a biological mechanism responds to being ripped out of one habitat and forcefully compelled to exist in another. But we have only to look at our zoos. . . .

Apologists for both schools-as-they-are and for slums (and they *do* tend to be the same people) often explain that life is grim and earnest, that existence is a continuous battle where the strong reap victory, and

that the young are merely being taught to be tough in order to survive more easily in a tough world. Certainly we have managed to make life grim and earnest, aided by 2,000 years of the Judeo-Christian moralizing and sermonizing. But with the advent of more leisure and the prospect of abundance for all, life will surely take on the qualities of joyousness, awareness, uniqueness, self-actualization, communication, empathy, non-conditional love, and transcendental ecstasy. The concept that the strong will perpetually triumph over the weak ("... a boot stamping on your head, forever...") is partially based on a perversion of Darwin's *Origin of Species* theory, "survival of the fittest," as consciously misinterpreted by the rising capitalist class in late nineteenth-century England and America. Partially it arises from the concept that there "is not enough to go around," a historical fact until recently. But the fact of the matter is that today there is more than enough to go around for everyone if only it is properly planned, distributed, and consumed. There is a second fallacy in the concept of the school as a toughening-up ground for the hazards of life.

According to Dr. M. W. Sullivan, quoted in George Leonard's *Education and Ecstasy*, during World War II members of the United States Marine Corps fighting in the South Pacific were exposed to some of the most insufferable conditions in history. Climate, vegetation, and wildlife made life nearly unbearable; the added hazards of battle and disease were incredible. A study showed that the men coming from deprived environments, in other words, those who had been "toughened up for life," were the first to crack up. The Marines whose background had been both an enriched and a more tranquil one more easily withstood the ravages of environment and enemy action. The same experience also has been documented by Dr. Bruno Bettelheim for the inmates of Nazi extermination camps, and held true of captured American soldiers during the Korean War (cf.: *In Every War But One* by Eugene Kincaid, published in 1959 by Norton).

In a dramatically changing world society that is (tremblingly) afraid of change and that educates its young into ever-narrowing areas of specialization, the integrated, comprehensive, anticipatory designer is a dedicated synthesist. Much of the hope lies in the fact that a society grown too large and complex to understand itself or to respond to new events is often unaware of the changes taking place within it. Thus, while much publicity has been given to the fact that more than half of all the people alive today are 25 years old or younger, that by 1986 considerably more than one third of all the people will be less than 15 years old, that even today China has more children under 10 than the total all-age population of Russia and the United States combined, the world has made no relevant responses to these facts. Today there are more college students in the United States than there are farmers. Yet the overly generous subsidies provided for American farmers (at a time when agricultural workers accounted for 98 per cent of the population, rather than today's 7 per cent) are still enforced. The student population is treated to tear gas and clubbings by the police. Buckminster Fuller observes: "Each child today is born in the presence of less misinformation." The accelerated up-grading of so sizeable a part of the population in our schools and universities will inescapably affect all our systems.

Much is done by the power structure, both inside the schools and out, to keep young people from either realizing their power or fulfilling their potential. One answer is war. *"Every 20 years or so we scrap a generation by violent and expensive means, and very soon it is the expense and not the scrapping that bothers us"* (Michael Innes). And in the universities we teach narrow, specialized vocational skills (with the emphasis on "earning a living") while paying lip service to "educating the whole man" (in order to supplement the skills taught and turn the students into competent consumers).

The fact is that nearly all of us are so victimized by the propaganda of the profit system that we are no longer able to think straight. During the summer of 1969 when the Swedish government acquired a 10 per cent slice of the Swedish pharmaceutical industry, a leading paper in Stockholm pushed the panic button, saying that if Sweden's entire drug industry were to be socialized, why then "they would only produce what is needed." (!) While ridiculous, the point is well taken. For in industrial circles today, most major research concerns itself not with producing for discovered needs, but rather with propagandizing people into desiring what has been produced. *If industry in all countries were to "produce only what is needed," the future would look bright indeed.*

However, members of the industrial design profession continue to support and, in fact, lead the profit-seeking system. David Chapman is the owner and director of one of the largest firms in the United States. He is a Member of the Board of the Industrial Designers Society of America and has been elected a fellow of both the Royal Society of Arts in England and the International Institute of Arts and Letters in Lindau, Germany. Here is what he has to say* about what he considers to be true market needs:

The gift market is another enormous area. In 1966, exclusive of Christmas presents, 90 million people received 107 million gifts. Over 40 per cent of table appliances are gifts, even though nobody packs or designs them as gifts. They're designed with some stubborn suspicion that they're meant to *work*. Well, they are—but who *needs* a blender? (Italics by Chapman)

He continues, somewhat dejected, over a market that does not, alas, yet exist:

* In *Design Seminar*, a report published by the American Iron and Steel Institute, pp. 4-5.

There are 35 million pets in the United States. The owners of those pets spend \$300 million a year on pet food, but *only \$35 million each year on pet "things."* No one has offered the owner a thing to buy for Rover. It is probably possible to get mink collars at Neiman-Marcus, but *no such merchandise crosses America.*

Mr. Chapman also talks about the food needs of the United States. After explaining that "the kitchen is as dead as a dodo" and that "the kitchen business—just as the buggy whip—is on its way out," he says that we shall all eat TV dinners. However, he adds reassuringly: "Mamma may give the food a pinch of oregano or shot of sherry for womanly, psychological reasons."

"Designers must learn a lot more about the effect of social factors on products and markets," he continues, and adds, "there are 75 million Americans over 45—25 million of them over 65. *They have dentures, stomach trouble and things like that. It's a whole new market* and they have lots of money to spend on the things they want" (my italics). Having thus explored the problems of nutrition, the elderly, the sick, and the needy (!), Mr. Chapman triumphantly concludes:

On a new car, for instance, the list price was recently \$2,500, but with the extras the car cost \$4,200. Who *needs* whitewalls? They don't last longer, *they look cuter.* It is possible to mis-recognize the kind of animal we are all dealing with. Basically, it is a creature seeking total indulgence.

When Mr. Chapman uses words like "animal" and "creature," he is talking about you and me: consumers, clients, his public.

Historical note: Because of many outraged letters, telephone calls, and even one telegram I received in the past, accusing me of inventing both Mr. Chapman and the quotes given above, I should like to confirm that David Chapman really exists, and he really is a

fellow of the Industrial Designers Society of America, an honorary member of many international design societies, and an esteemed spokesman of the American Design Establishment. Moreover, Mr. Chapman was not being sarcastic in any of the above comments; in fact, he went to the trouble of having them printed up in a pamphlet (called "Design Seminar") and had his office mail out hundreds of copies to fellow designers and students.

Actually, his remarks are, if anything, a great deal more moderate than those of others in his field. More extreme viewpoints dominate the field, the designers' societies, professional meetings, and, what is most disturbing, most design schools in the United States today. Unblushingly, industrial design in America has elected to serve as pimp for big business interests.

Ironically, most of the real "plums" or "glamour jobs" the majority of industrial design students in the United States are educated to deal with and delighted to nab just happen to be with blue-chip American firms whose policies and practices are far from progressive when it comes to respecting the public interest generally and people's need for low-cost, ecologically wise,* and aesthetically pleasing products. In fact, many American corporate giants have been involved in litigation with the government on charges of either anti-trust violations or product liability suits. However, even when anyone manages to win convictions against such companies in court, punishment often seems ridiculously light. In other words, in teaching industrial design as we do, we prepare young people to aid and abet people who fail to measure up to even the prevailing minimal standards that our judicial agencies so feebly enforce.

Here is one example: in the spring of 1970 the

* On June 30, 1971, when firms that pollute were to file statements with the Federal Government, only 50 out of an estimated 80,000 had bothered to do so.

big 3 automobile firms were charged before the Supreme Court. They were accused of having conspired for 17 years to keep anti-pollution devices off the market. The three firms admitted this. They begged the courts, however, not to prosecute in exchange for their promise that they would try harder (!), presumably during the next 17 years.

One gratifying fact is that many young people studying design today are unwilling to go on being fed the pap that the schools dispense so readily. As Bill Blau suggested in his piece in *Fortune* a few years ago, the role of this old-fashioned design is slowly coming to an end. If we list a few of the new generation of products to be expected within the next ten years at most, and if we furthermore restrict this listing to products serving *only the Western world*, we will find:

- Hovercraft
- Monorail systems
- Ultra-compact electric cars
- Personal, battery-driven mobility devices
that can easily be hand-carried
- Mass-produced multiple-use buildings
- Automated traffic
- Computerized medical diagnostic devices
- Television-phones
- Computer-access consoles in the home
- Education through television
and teaching machines
- De-polluted manufacturing systems
- Wide use of bio-degradable materials

The effect of these new products would be to leave us with completely obsolescent roads, automobile factories, schools, universities, housing, factories, hospitals, newspapers, magazine and book publishers, stores, farms, railroad systems, etc. It is not difficult to see why big business is afraid of changes that may phase out its plants and products *as we now know them*.

As factories and industrial combines grow in size, complexity, and investment capital, their opposition to innovation grows. Changes in the system, replacements of the system itself or parts of it become more costly to contemplate and more difficult to institute. Directions of change therefore cannot be expected to be initiated by big business or the military-industrial complex (or the tame, captive designers working for them) but will be initiated by the design team.

To do the most effective job possible, a great deal of research will be needed. A great many questions (most of them trans-national in character) need to be asked. All of these are rather big questions indeed:

What is an ideal human social system? (This will mean an in-depth study of such diverse social organizations as American Plains Indians, the Mundugumor of the Lower Sepik River basin; the priest-cultures of the Inca, Maya, Toltec, and Aztec; the Pueblo cultures of the Hopi; the social structuring surrounding the priest-goddess in Crete; the mountain-dwelling Arapesh; child care in Periclean Greece; Samoa of the late nineteenth century, Nazi Germany, and modern-day Sweden; hunting customs among Australian aborigines, Bantu, and Eskimo; the place of authority and decision-making in China, imperial Rome, slums, and ghettos, and the Loyalist Regime in Spain; delegation of authority in armies, the Catholic Church, modern industrial networks; etc., etc.)

What are optimal conditions for human society on earth? (An inquiry into living patterns, sexual mores, world mobility, codes of behavior, primitive and sophisticated religions and philosophies, and much more will be needed here.)

What are the parameters of the global ecological and ethological system? (Here new insights from such diverse disciplines as meteorology, climatology, physics, chemistry, geology, Von Neumann's Game Theory, cybernetics, oceanography, biology, and all the behavioral sciences will be urgently required; as well as ways of establishing links between these disciplines.)

What are the limits of our resources? (Studies comparable to those carried on by the World Resources Inventory Center at Southern Illinois University will have to be brought into continuous contact with changing technologies and new discoveries.)

What are the human limits?

What are the basic housekeeping rules for human life on the planet earth? (Or, in Bucky Fuller's phrase: *An Operating Manual for Spaceship Earth.*)

And, finally, what don't we know?

There are very few answers to any parts of these questions as yet. But the first beginnings have been made in creating tools that may help to begin giving us answers. The International Geophysical Year and the International Years of the Quiet Sun and the International Upper Mantle Project were all recent scientific data-gathering attempts of a trans-national character. Agencies already exist. UNESCO, UNICEF, the World Health Organization, the International Labour Organisation, the Scientific Committee of Water Research, the International Council of Scientific Unions, the Intergovernmental Oceanographic Commission, the International Committee of Manpower Resources are just a few of some of the organizations now in existence who gather, store, and retrieve data of global importance.

There is no question but that an International Council of Anticipatory Comprehensive Design should be established at the earliest moment. It might well be partially funded by and work with UNESCO.

But doing the gigantic research task is only one third of the job that needs to be done to come to grips with the needs of the world.

The second is the immediate pre-empting of presently wasted design efforts, and the redirection of these efforts towards short-range practical design needs. One way of achieving this at once has been suggested in Chapter Four as *kymmenykset*. It suggests that designers and design offices immediately begin turning at least one tenth of their talents and

working time towards the solving of those social problems that may yield to design solutions. Furthermore, it means (as suggested in Chapter Ten) that designers refuse to participate in work that is biologically or socially destructive (whether directly or by implication is of no importance).

Just this would be a gigantic step towards the common good. We have marveled together, in an earlier chapter, that merely by eliminating the rotting of food and by stopping the destruction of food by vermin, the total protein intake of billions now suffering would be raised from starvation to nutritionally acceptable levels. The same can be done in design. Merely by eliminating the social and moral irresponsibility now prevalent in what I'm tempted to call *all* design offices and schools, the needs of the neglected half of the world could be met.

Finally, and as our third point, completely new directions must be explored in the education of young designers. While this topic has been given an entire chapter to itself, some further observations are in order.

The unchecked growth of schools, colleges, and universities has created an environment that is harmful to innovation or, for that matter, education. The problem of size alone (the university at which I used to teach has 27,000 students, and there are universities more than 3 times as large) works against education. It tends to make students feel like cogs in a machine, reduces them to numbers, and alienates them. This fragments their efforts, and a true learning situation cannot arise. At the other end of the scale there are private schools which are considered "small" with between 500 to 3,000 students. These institutions substitute exclusiveness and the atmosphere of a country club for the giantism of state universities. The third type of school is usually a highly specialized one, dealing with the specific problems of the arts, crafts, or what-have-you. These schools suffer from a lack of broad general resources and subject matter and tend

to perpetuate the exclusivity of artists-craftsmen and the formation of little cliques. The fourth possibility, as set up in London in July of 1969, is a university open to all, where courses are taken via correspondence, radio, and television. This last model effectively removes all interaction between students or students and teachers.

In all likelihood there are reasons and needs in our society that can be used to justify all four of these methods of teaching. But young people are forced to make a choice between size and exclusiveness.

Alternate ways of learning and interacting are already being found in many places. The Esalen Institute at Big Sur, California, conducts a peripatetic seminar in the behavioral sciences, psychotherapy, and self-awareness. Branches of Esalen have been set up at San Jose, at Stanford, and in San Francisco. Similar institutes exist in over 250 cities. The growth of the Human Potential Movement is one of the more startling phenomena of the last few years. At least one school, the School of Design, California Institute of the Arts, is attempting to build the behavioral sciences and social design into its regular design curriculum.

In today's renaissance of crafts, weaving, silver-smithing, glassblowing, ceramics, and sculpture are both practiced and taught in small centers that are directed primarily towards the summer vacation "trade." Such centers exist in Maine, California, New Mexico, Michigan, Wisconsin, and North Carolina, and new ones are springing up all the time. The Penland School of Crafts in Penland, North Carolina, may well be the most successful one of these. Through its summer tuitions, it supports a group of "resident craftsmen" throughout the other 9 months of the year. Penland is dedicated to a free mix of professional craftsmen, craft teachers, college students, retired couples, little old ladies in tennis shoes, and world-renowned designers. It also acts as a germinal force in re-establishing a "cottage industry" based on the crafts in the nearly inaccessible small farms in southern Appalachia.

Many of the communes are craft-oriented; some of them manage to support themselves through what they make.

New Schools Exchange Newsletter, The Whole Earth Catalog, the Canadian Whole Earth Almanac, Mother Earth News, Green Revolution, Modern Utopian, and The Alternate Society News are a few of the channels of communication and information that are being built to by-pass existing but outmoded forms.

Frank Lloyd Wright tried to create a milieu that would be conducive to the study of architecture and planning at Taliesin and Taliesin West. Unfortunately this experiment, lasting some thirty years, was too strongly overshadowed by Mr. Wright's own powerful personality. With this (architectural) exception, the study, research, and practice of design and planning as socially and morally responsible activities have not been attempted so far.

It seems crucial that such an experimental design milieu be established somewhere in the world at once. I envision it less as a school than as a working environment. Here, young people would "learn" through working on real design problems rather than artificially constructed exercises. Such a working environment would, of necessity, be small in size, at no time accepting more than 30 "students" at most. Part, although a minor part, of its function would be to serve as a prototype for similar environmental design workshops to be set up as an interacting global network. Ultimately, students might then have the choice between one school with 30,000 students versus 1,000 environments of 30 students each.

The young people coming to this first, prototypical school would come freely from all parts of the world. They would stay for a year or longer and participate in the simultaneous learning and practicing of integrated design. These young men and women would be of varied backgrounds, differing age groups, with study and work experiences in many different fields. At all times they would operate as a multi-disciplinary

design team. Their work would be socially relevant and always "real." By this I mean that, rather than setting to work on theoretical problems chosen only for their similarities to problems dealt with in professional design offices (as is done in all schools), members of the team would direct their attention to the actual needs of society. In other words, all the work carried on in this milieu would be anticipatory.

Such an environment would satisfy a major social need not filled today: the creation of a body of designers trained in the skills that the future will demand of them. Just as astronauts and cosmonauts are taught skills that may be demanded of them months or years hence on the moon or Mars, the design team too will have to prepare itself for the social challenges of integrated comprehensive design that the future will bring. The solutions of design problems will be turned over to concerned individuals, social groups, governments, or trans-national organizations.

As this entire concept of an experimental design environment is thought of as non-profit-earning, any money "earned" through solving these real problems would be directly returned to the work group as tools, machinery, devices, structures, and land. We only have to examine learning situations which people find rewarding, "fun," and in which they learn optimally, to see why the small size of this group is important.

Earlier in this book I discussed learning to drive a car. This skill is taught on a one-to-one, teacher-student ratio. It is further reinforced by the equipment used (the car) and the environment. Other, similar, valuable learning situations are ski schools and swimming schools. Here again the emphasis is on a small teacher-student ratio, a mutually interactive and mutually reinforcing group, and the action of this group within the environment. Most importantly, perhaps, the "teacher" possesses and practices the identical skills which the "students" are learning. He is never a remote professor, tied up within the ivory tower of his own research (as is the case in the universities).

Nor is he a "teaching assistant" or graduate student so busy with his own studies that he can give only scant attention to his students.

There is no question that teachers (especially in design) must be constantly involved in its practice. But only a system such as the one proposed here will eliminate the false divorce between practice and teaching.

All members of this team would live and work communally. Their existence would be eased through the whole concept of "communal sharing": that is, consuming more, but owning less. A representative group of 30 present-day university students will serve as one small example: they own, on the average, 26 automobiles, 31 radios, and 15 high-fidelity systems. Without belaboring the obvious, such a capital investment in transient consumer goods would eliminate itself. While expediency would demand the starting of such a "school" in a series of old buildings, a farm, or the like, the eventual buildings would be the responsibility of the team. Temporary domes, information-input cubes (à la Ken Isaacs), and the constructing of more permanent working rooms, sleeping spaces, and social spaces would provide team members with valuable experiences in a living-working environment—one that is constantly changing, constantly being questioned and experimentally restructured through their own thinking and their own labor.

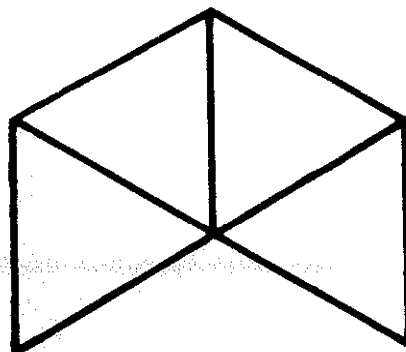
Their "curriculum" would be a loosely woven mesh of those activities and skills needed for creative problem-solving. There could be no separation between their "work" and their leisure-time activities. The newest methods of data-processing, film-making, etc., would be available to the team. Such a center of design research and planning would have to be able to offer its hospitality freely to specialists from many disciplines. Such concerned workers could then be drawn into the working and living experiences of the team for a few days, weeks, or even a year. Because of the experimental nature of the various structures making

up the environment, such a center would best be located in the country, but close enough to major urban centers to participate in studies, internship work, and experiences in the city environment. What is studied, and how, would evolve organically out of the needs of society. There could never be a static "plan of study."

There is no question but that within two or three years some members would leave, their minds full of ideas for a better way of running such an environment. This is unavoidable, and would bring about dynamic changes. For it is my belief that if such a center were to be established, soon similar centers would "spin-off." These new centers would be able to address themselves to local and regional problems around the world. They would form the first links in a network of such environments. At each center, young people would be encouraged to travel widely. Such travel could well include a few months' or years' stay and participation in the work at another center. Two things are proposed here: the establishment of a learning-working environment for thirty young people; and, optimally, a new life style for the peoples of the world.

In the preceding chapter I have explored the dynamics of the integrated designer's methods of problem-solving, and diagrammed them. By now, it will be obvious that I have written this entire book according to this same diagram (as shown below). It has been derived from the in-put of many flow charts. (If

**DIAGRAM OF ONE CYCLE OF
INTERLOCKING DESIGN "EVENTS".**



it lacks a smooth, linear sequence, it may be put down to that.) The task at hand has been to present you, the reader, with a collection of jig-saw puzzle pieces, which I urge you to put together in whatever pattern seems most relevant. There is no other way of presenting the simultaneity of events.

Books like this are expected to end with a dazzling view of the future, and ordinarily this would be the place to speak about vast cities under the ocean, colonies on Mars and Proxima Centauri, machines that will provide us with an everlasting cornucopia of electronic gadgets. But that would be insane.

Design, if it is to be ecologically responsible and socially responsive, must be revolutionary and radical (going back to the roots) in the truest sense. It must dedicate itself to nature's "principle of least effort," in other words, minimum inventory for maximum diversity (to use Peter Pearce's good phrase) or, doing the most with the least. That means consuming less, using things longer, recycling materials, and probably not wasting paper printing books such as this.

The insights, the broad, non-specialized, interactive overview of a team (heritage of early man, the hunter) which the designer can bring to the world must now be combined with a sense of responsibility. In many areas designers must learn how to de-design. In this way we may yet have "Survival Through Design."

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This bibliography is startlingly long; it runs to almost five hundred titles. Having just written a book on design as a multi-disciplinary approach, I have tried to make the bibliography multi-disciplinary as well. Consequently, books dealing with ecology, ethology, economics, biology, planning, psychology, literature, anthropology, politics, and the behavioral sciences are listed together with books on the future, the environment, popular culture, and design.

These books are not a "suggested reading list" because they reflect entirely too many personal preferences of my own. (Nor does this bibliography attempt to list all the books I have read that have led me to form my convictions. Obviously my own reading list has been considerably larger than suggested by this listing.) Much has had to be left out. This might be the place to mention the influence of Tolkien's *Lord of the Rings* trilogy, Robert Heinlein's *Stranger in a Strange Land*, Göran Palm's *As Others See Us*, and almost everything my friend Henry Miller has written.

The function of this bibliography is to suggest half a thousand books, none of which would make a bad beginning for a designer or a student wishing to read into other areas.

Not many books about design are represented here. But listing all the books on design would mean listing some of the worst ones, repeating bibliographies found elsewhere, and breaking no new ground in widening the design field towards other disciplines. This would be inexcusable in one of the first books on industrial design to be published in nearly one and a half decades.

Certainly one book published in 1970—*Design in America* (by the Industrial Designers Society of America)—is no more than an expensive coffee table volume, which painstakingly, extravagantly, and unconsciously illustrates all the points that I have made in

this book. When a sales-directed, profit-oriented, ecologically disengaged society practices design, books like *Design in America* use beautiful photographs to illustrate the symptoms of our sickness, rather than listing the causes. But it is fatal to mistake the hectic flush of a final coma for the radiant glow of health. . . .

From the linear thinking of the Renaissance (that great setting of the sun, which man mistook for the dawn), when men still thought all their knowledge classifiable, we have inherited our graphs, divisions, classifications, and lists. Typically when we wish to classify areas of knowledge too vast to be so comprehended, we make the crowning mistake: we educate *specialists*.

But as we go towards the year 2000, as we see divisions that the last few generations have painstakingly erected out of the quicksand of their statistician's minds crumble away, we find no need for more such distinct areas but for unity. Not the *specialist* then, but the *synthesist*.

This is the way in which a meaningful organic pattern, unity, synthesis, will grow between you and each book you read. Out of all the battles you have with the author, the enlightenments and insights his book gives you, the mistakes and confusions you will discover in his work, there *will grow a new entity*, and it will be your gain, and your gain alone.

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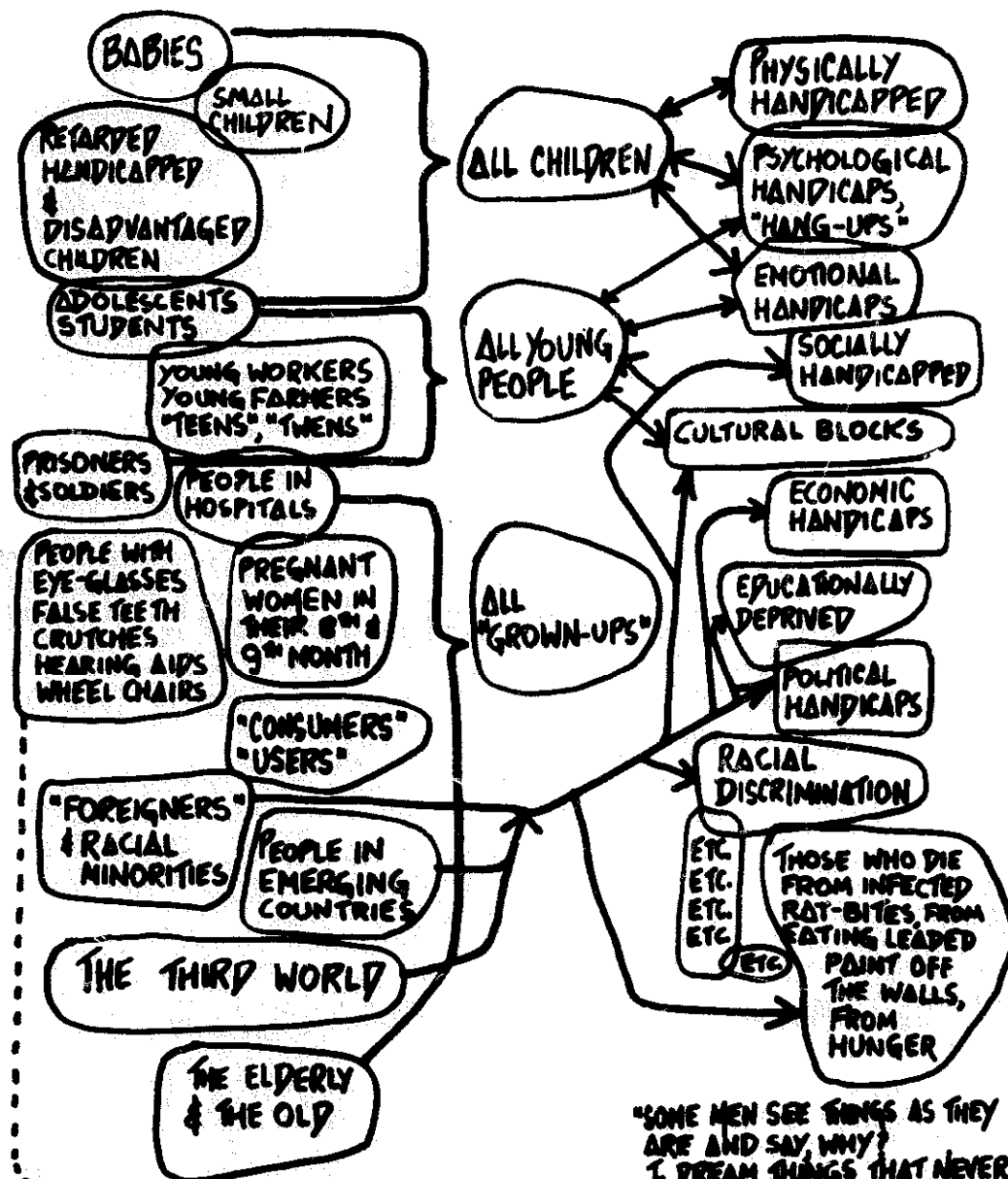
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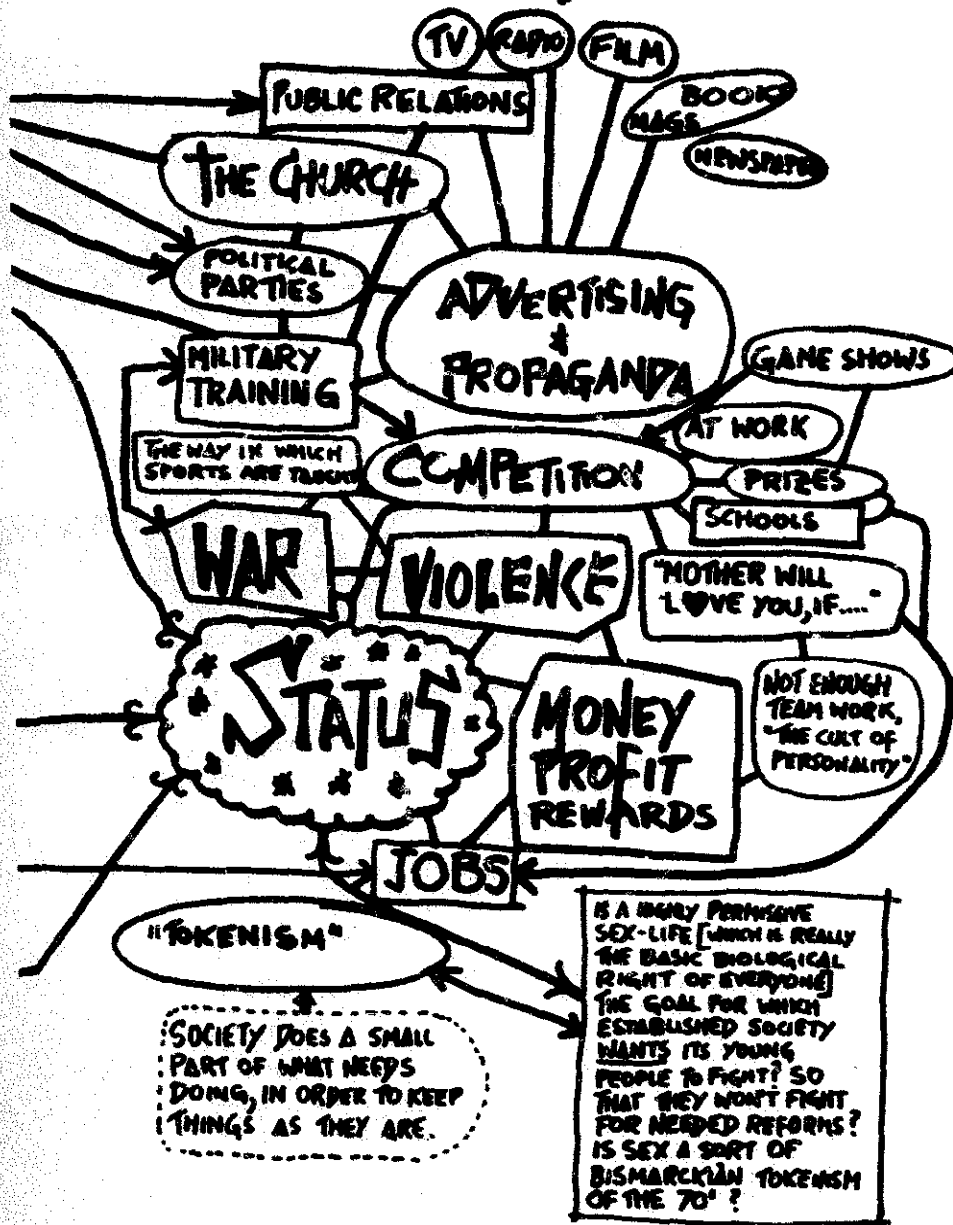
Victor Papanek is a UNESCO International Design Expert and Dean of the School of Design at the California Institute of the Arts, where he teaches bionics and design strategies. Professor Papanek has taught and traveled in seven countries and lived with an Eskimo tribe as well as with Hopi Indians. He studied at Cooper Union in New York, at the Massachusetts Institute of Technology, and with the late Frank Lloyd Wright at Taliesin and Taliesin West. In North America, he has taught at the Ontario College of Art (Toronto), the State University of New York (Buffalo), the Rhode Island School of Design (Providence), Penland School of Crafts (North Carolina), and Purdue University (Lafayette, Indiana). Professor Papanek has also specialized for years in design for the handicapped, the Third World, the sick, the poor, and people in need, and much of his work has been in bionics and medical devices. With James Hennessey, he is coauthor of *Nomadic Furniture*, published this year. He lives with his wife and young daughter in Valencia, California.



* "BLINDNESS" FOR INSTANCE INCLUDES BOTH DICHOTOMOUS & TRICHOTOMOUS COLOR-BLIND PEOPLE, GLAUCOMA, TRACHOMA, CATARACTS, ANYTHING LESS THAN 20/20 VISION, MYOPIA AND ALMOST 200 MORE DISEASES.

"SOME MEN SEE THINGS AS THEY ARE AND SAY WHY? I DREAM THINGS THAT NEVER WERE AND SAY, WHY NOT?"
RFK

HOW FALSE GOALS ARE ACHIEVED:



HOW REAL GOALS
ARE PREVENTED:

PRISON

UNEMPLOYMENT

POLITICAL EXILE

EDUCATION
FOR CONFORMITY

DEATH PENALTY

RELIGIONS:
FAITH IN HEAVEN AND
AFTER-LIFE → NO
INTEREST IN CHANGING
THINGS NOW.

BELIEFS LIKE:

• Gott mit uns «
HOLY WAR»

my country,
right or wrong

AMERICA: LOVE IT
OR LEAVE IT!

DISCRIMINATION
RACE WAR
GENOCIDE

HOW TO CHANGE
THIS:

EXHIBITIONS
FREE UNIVERSITIES
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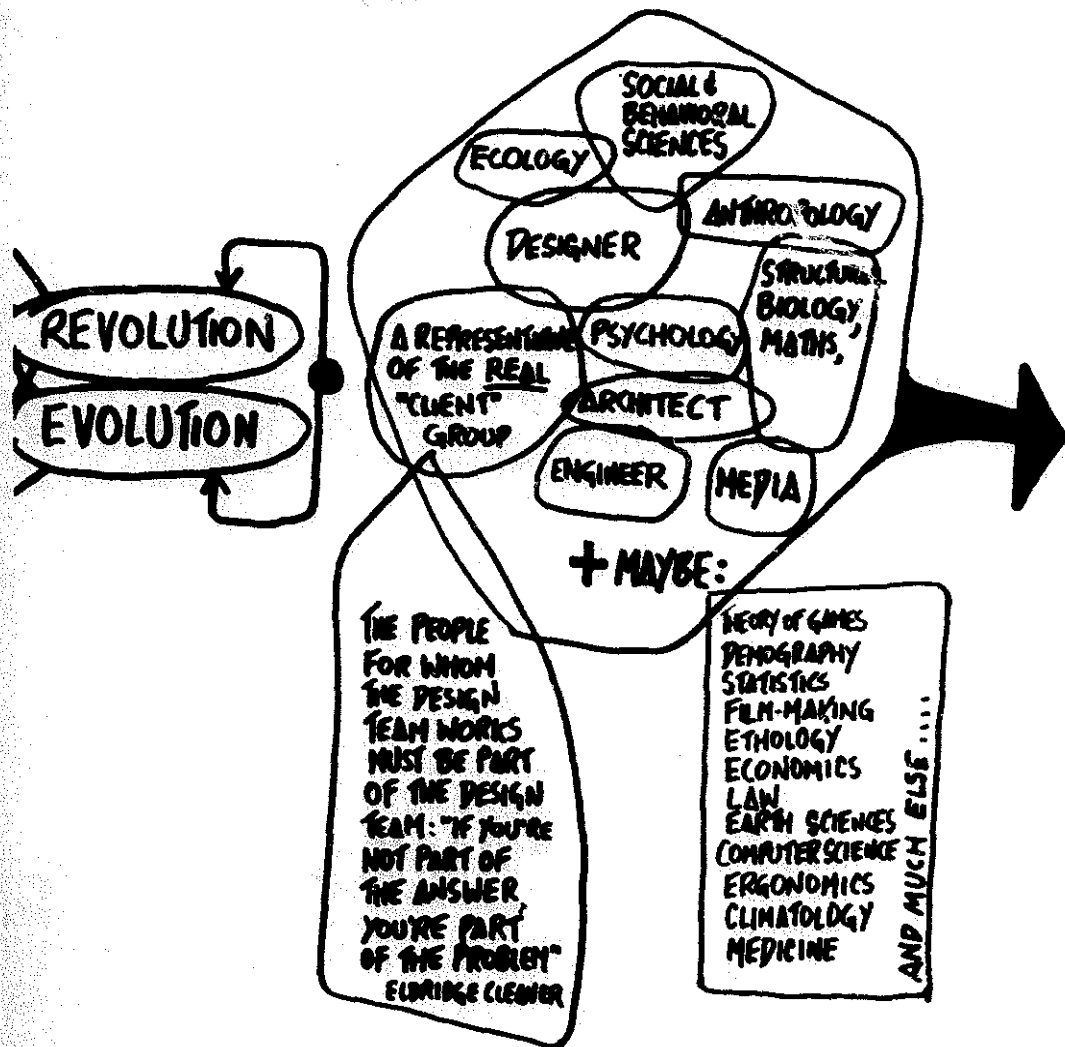
SOCIAL
PLANNING

RESEARCH

ALL THIS
IS "DESIGN".

"ALL OF US LIVE IN THE
GUTTER, BUT SOME OF
US ARE LOOKING AT THE
STARS."
OSCAR WILDE

THE MINIMAL DESIGN TEAM:



RANDOM THOUGHTS:

ALL PEOPLE ARE HANDICAPPED
FOR AT LEAST PART OF THEIR
LIVES, IN SOME WAY. AS DESIGNERS
WE MUST FIND THEIR REAL NEEDS.

HOW HAVE OTHER SOCIETIES
LIVED IN THE PAST? HOW ARE
OTHER SOCIETIES LIVING IN
OTHER PARTS OF THE WORLD?
HAS THIS PROBLEM ALREADY
BEEN SOLVED, SOMEWHERE OR
SOMEWHEN ELSE?

"GOOD TASTE" IS AN
INVENTION OF MERCHANTS,
DESIGN & FOLK-ART DON'T
HAVE IT. "GOOD TASTE" IS
TO CREATE FASHION FOR
PROFIT.

With computers &
automation, creative
problem-solving is
more urgent than
ever. We can construct
conceptual models of
many different environ-
ments & try them out.

"YOU HAVE TO MAKE UP YOUR
MIND EITHER TO MAKE SENSE
OR TO MAKE MONEY, IF YOU
WANT TO BE A DESIGNER."
BOBBY FULLER

THE ONLY THING THAT DOES NOT CHANGE
IS CHANGE. EDUCATION MUST BE ECSTATIC
AND FOR TOMORROW...

"WE HAVE NO ART, WE JUST DO THINGS AS WELL AS WE CAN"
BALINESE PROVERB

WE SEEM TO BE DESIGNING EXCLUSIVELY
FOR THE OLD, THE FAT, THE RICH, THE WHITE,
THE POWERFUL; THE ONES WHO HAVE
MANAGED TO GET US INTO EVERY SINGLE
MESS AND FRIGHTFULNESS MANKIND HAS
SO FAR EXPERIENCED. TO CREATE LIPSTICK FOR
HONEST WHORES IS ONE THING, BUT TO CREATE DEODORANT FOR HER PIMP
IS ANOTHER.

"TELLING LIES TO THE YOUNG IS WRONG
PROVING TO THEM THAT LIES ARE TRUE
IS WRONG

...THE YOUNG KNOW WHAT YOU MEAN.
THE YOUNG ARE PEOPLE.
TELL THEM THE DIFFICULTIES CAN'T BE

COUNTED
AND LET THEM SEE NOT ONLY WHAT WILL BE
BUT SEE WITH CLARITY THESE PRESENT
TIMES."

YEVGENY YEVTSYUKENKO

"If a free society cannot help
the many who are poor, it
cannot save the few who are
rich." JFK

"WE ARE NOT REHEARSING FINAL GESTURES, WE WANT
LIFE AND WE SHALL DEFEND IT." ONE

"WHEN YOU MAKE A THING, A THING THAT IS NEW,
IT IS SO COMPLICATED TO MAKE IT
THAT IT IS BOUND TO BE UGLY.
BUT THOSE THAT DO IT AFTER YOU
THEY DON'T HAVE TO WORRY ABOUT MAKING IT.
AND THEY CAN MAKE IT PRETTY, AND SO EVERYONE
CAN LIKE IT,
WHEN THE OTHERS
MAKE IT AFTER YOU." PICASSO

"IT IS NOT ENOUGH TO ALLOW DISSENT.
WE MUST DEMAND IT. FOR THERE IS MUCH
TO DISSENT FROM..." RFK

"ONE CANNOT BUILD LIFE FROM REFRIGERATORS,
POLITICS, CREDIT STATEMENTS AND CROSSWORD
PUZZLES. THAT IS IMPOSSIBLE. NOR CAN ONE EXIST
FOR ANY LENGTH OF TIME WITHOUT POETRY, WITHOUT
COLOR, WITHOUT LOVE."

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